

QS65SCM65D2P

650V N-channel

SiC MOSFET



General Features

- Fast Switching with Low EMI/RFI
- Simple to Drive and Easy to Parallel
- Low Gate Charge Minimize Switching Loss
- Short Circuit Withstand Rated
- Improve Efficiency

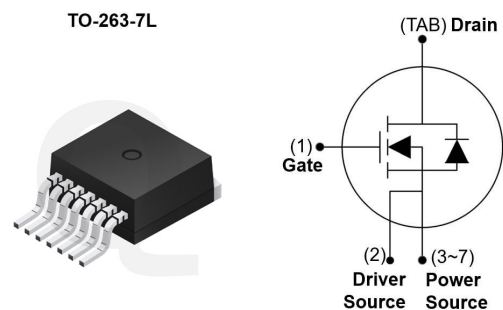
General Features

| Parameter | Value | Unit |
|-----------------------|-----------|------|
| BVDSS | 650 | V |
| RDS(ON),typ. VGS=20V | 32 | mΩ |
| VGS(TH) | 2.0 ~ 4.0 | V |
| Eon | 0.18 | mJ |
| Eoff | 0.09 | |
| ID TC=25°C | 73 | A |

Applications

- UPS
- SMPS
- Solar Inverters
- EV Charging
- Industrial Motor Drives

General Features



Ordering Information

| Part Number | Package | Marking |
|--------------|-----------|--------------|
| QS65SCM65D2P | TO-263-7L | QS65SCM65D2P |

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Absolute Maximum Ratings

TC=25°C unless otherwise specified

| Symbol | Parameter | Value | Unit |
|-----------|--|------------|------|
| VDSS | Drain-to-Source Voltage [1] | 650 | V |
| VGSmax | Maximum Gate-to-Source Voltage | -10 ~ +25 | |
| VGSop(DC) | Recommended operation Values of Gate to Source Voltage | -5.0 ~ +20 | |
| VGSop(AC) | Recommended operation Values of Gate to Source Voltage (f > 1Hz) | -5.0 ~ +20 | |
| ID | Continuous Drain Current | 73 | A |
| | Continuous Drain Current at TC=100°C | 51 | |
| IDM | Pulsed Drain Current [2] | 182 | |
| EAS | Single Pulse Avalanche Energy VDD=50V, VGS=15V, RG=25Ω, L=1mH | 288 | mJ |
| PD | Power Dissipation | 294 | W |
| | Derating Factor above 25°C | 2.0 | W/°C |
| TJ & TSTG | Operating and Storage Temperature Range | -55 to 175 | °C |

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

| Symbol | Parameter | Value | Unit |
|--------|---|-------|------|
| RθJC | Thermal Resistance, Junction-to-Case | 0.51 | °C/W |
| RθJA | Thermal Resistance, Junction-to-Ambient [3] | 40 | |
| RθJA | Thermal Resistance, Junction-to-Ambient | 63 | |

Electrical Characteristics

OFF Characteristics

TJ=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|--------|-----------------------------------|------|------|------|------|----------------------|
| BVDSS | Drain-to-Source Breakdown Voltage | 650 | | | V | VGS = 0V, ID = 100uA |
| IDSS | Drain-to-Source Leakage Current | | | 100 | uA | VDS = 650V, VGS = 0V |
| IGSS+ | Gate-to-Source Leakage Current | | | 100 | nA | VGS = +20V, VDS = 0V |
| IGSS- | Gate-to-Source Leakage Current | | | -100 | nA | VGS = -10V, VDS = 0V |

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ON Characteristics

T_J=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---------------------|--|------|------|------|------|--|
| R _{DS(ON)} | Static Drain-to-Source On-Resistance [4] | | 32 | 45 | mΩ | V _{GS} = 20V, I _D = 25A |
| | | | 35 | | | V _{GS} = 18V, I _D = 25A |
| | | | 45 | | | V _{GS} = 15V, I _D = 25A |
| | | | 39 | | | V _{GS} = 20V, I _D = 25A T _J = 175°C |
| V _{GS(TH)} | Gate Threshold Voltage | 2.0 | | 4.0 | V | V _{DS} = V _{GS} , I _D = 7.5mA |

Dynamic Characteristics

Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|------------------|-------------------------------|------|------|------|------|---|
| C _{iss} | Input Capacitance | | 1951 | | pF | V _{GS} = 0V V _{DS} = 400V f = 1MHz |
| C _{rss} | Reverse Transfer Capacitance | | 7.2 | | | |
| C _{oss} | Output Capacitance | | 179 | | | |
| R _G | Gate Series Resistance | | 6.1 | | Ω | f = 1MHz |
| Q _g | Total Gate Charge | | 87 | | nC | V _{DD} = 400V I _D = 25A V _{GS} = 0/20V |
| Q _{gs} | Gate-to-Source Charge | | 20 | | | |
| Q _{gd} | Gate-to-Drain (Miller) Charge | | 27 | | | |

Resistive Switching Characteristics

Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---------------------|---------------------------|------|------|------|------|--|
| t _{d(on)} | Turn-on Delay Time | | 12 | | nS | V _{DD} = 400V I _D = 25A V _{GS} = -3.5/18V R _G = 2.0Ω L = 0.1mH |
| t _{rise} | Rise Time | | 11 | | | |
| t _{d(off)} | Turn-off Delay Time | | 32 | | | |
| t _{fall} | Fall Time | | 10 | | | |
| E _{on} | Turn-On Switching Energy | | 0.18 | | mJ | |
| E _{off} | Turn Off Switching Energy | | 0.09 | | | |

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Source-Drain Body Diode Characteristics

TJ=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|------------------|-------------------------------|------|------|------|------|---|
| I _{SD} | Continuous Source Current | | | 73 | A | Maximum Ratings |
| V _{SD} | Diode Forward Voltage | | 4.0 | | V | I _S = 25A, V _{GS} = 0V |
| t _{rr} | Reverse Recovery Time | | 20 | | nS | V _{GS} = 0V I _F = 25A, di/dt = 1000A/us |
| Q _{rr} | Reverse Recovery Charge | | 65 | | nC | |
| I _{rrm} | Peak Reverse Recovery Current | | 5.0 | | A | |

Note:

[1] TJ=+25°C to +175°C

[2] Repetitive rating, pulse width limited by both maximum junction temperature

[3] Device mounted on 40mm x 40mm x 1.5mm epoxy PCB FR4 with a 6.25cm² pad of 2oz copper

[4] Pulse width ≤ 380us, duty cycle ≤ 2%

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Figure 1. Typical Output Characteristics

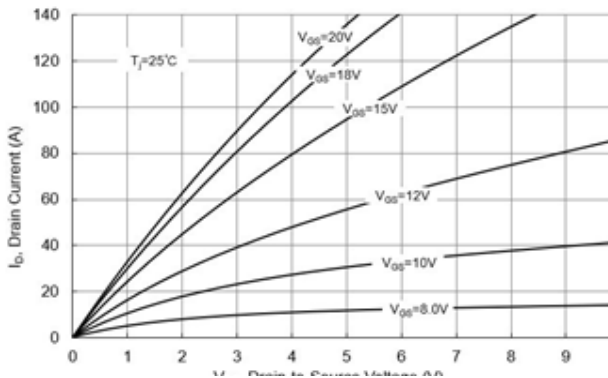


Figure 2. Typical Output Characteristics

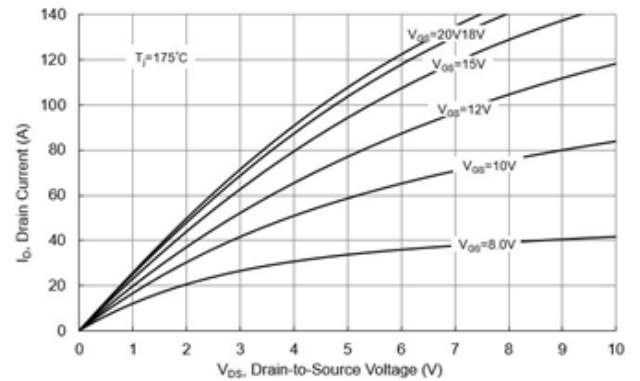


Figure 3. Typical Drain-to-Source ON Resistance vs. Gate Voltage

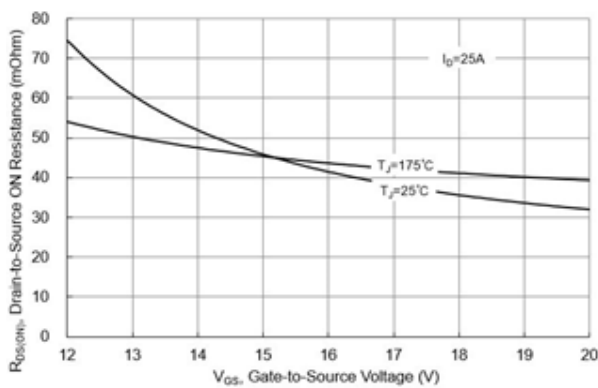


Figure 4. Typical Transfer Characteristics

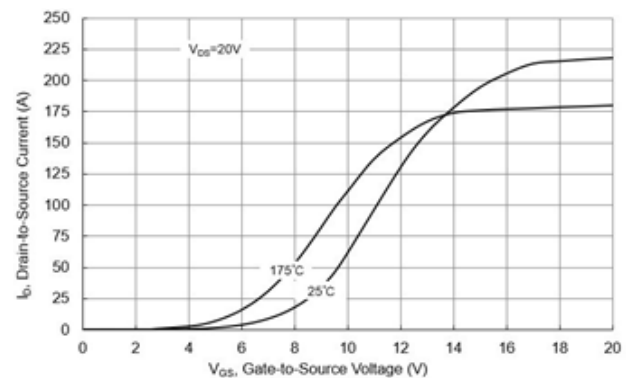


Figure 5. Typical Drain-to-Source ON Resistance

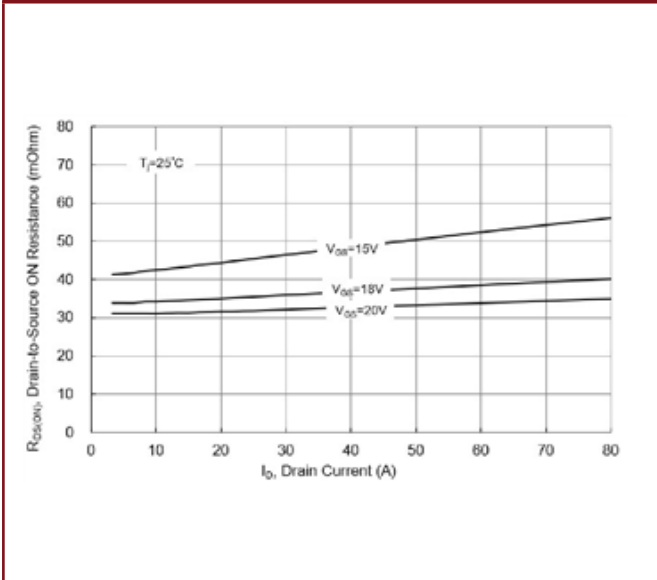


Figure 6. Typical Drain-to-Source ON Resistance

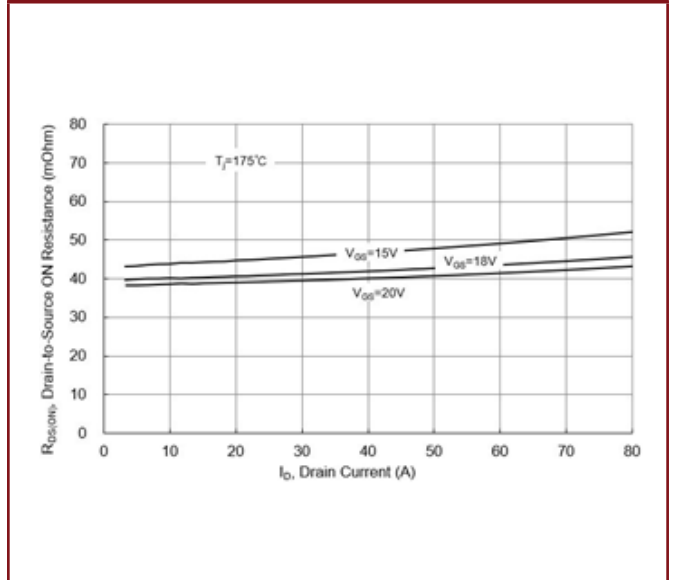


Figure 7. Typical Body Diode Characteristics

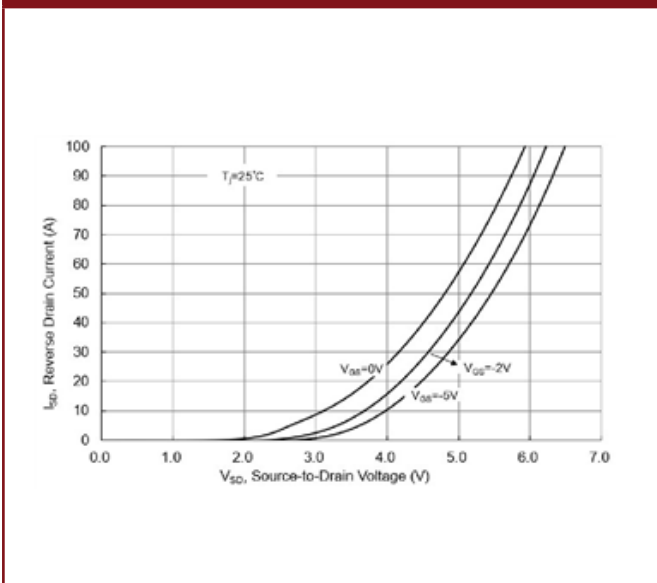
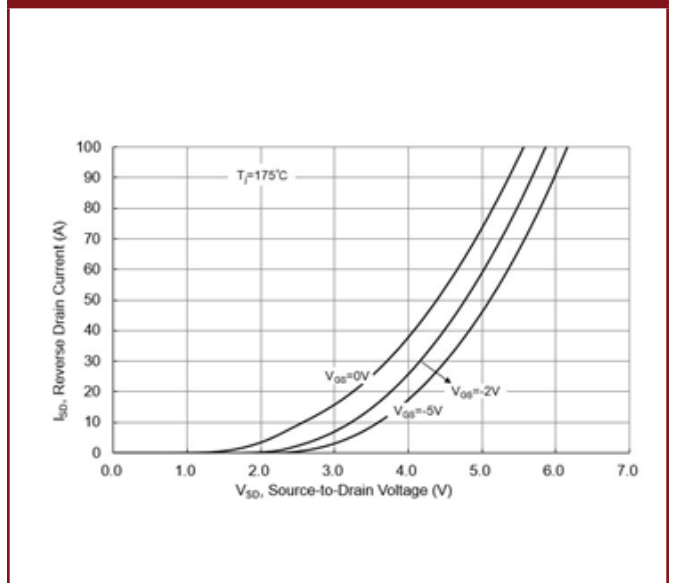


Figure 8. Typical Body Diode Characteristics



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Figure 9. 3rd Quadrant Characteristics

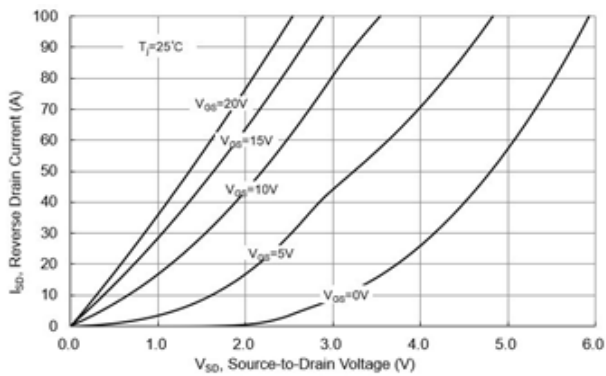


Figure 10. 3rd Quadrant Characteristics

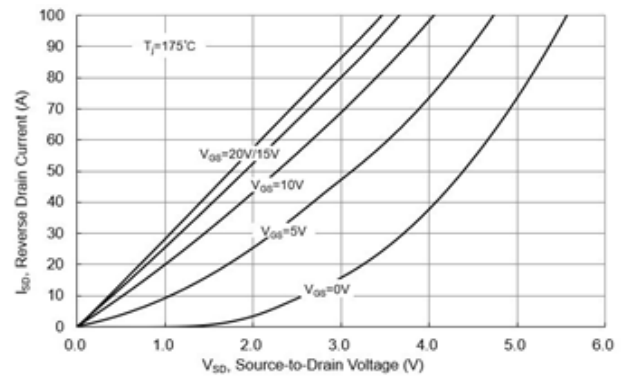


Figure 11. Typical Drain-to-Source On Resistance vs. Junction Temperature

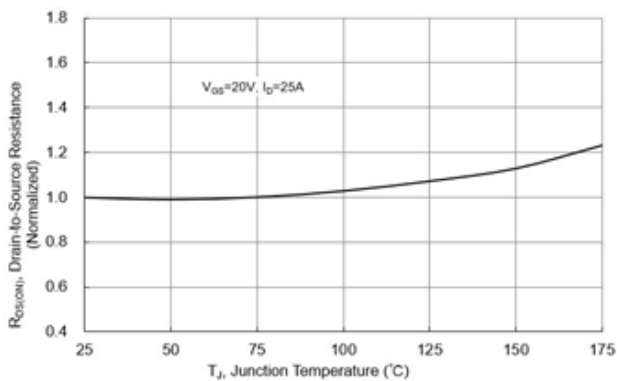


Figure 12. Typical Breakdown Voltage vs. Junction Temperature

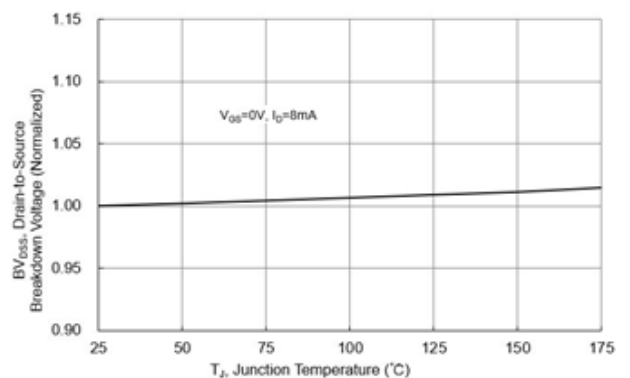


Figure 13. Typical Threshold Voltage vs. Junction Temperature

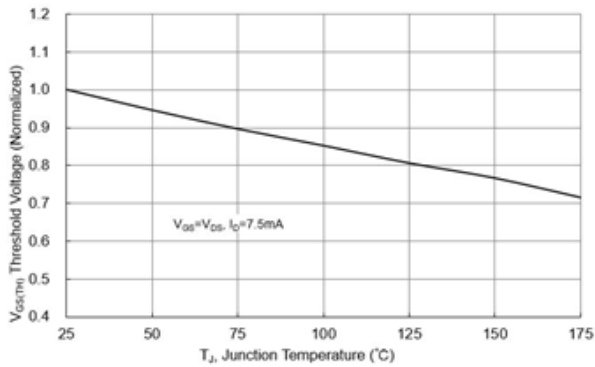


Figure 14. Typical Capacitance vs. Drain-to-Source Voltage

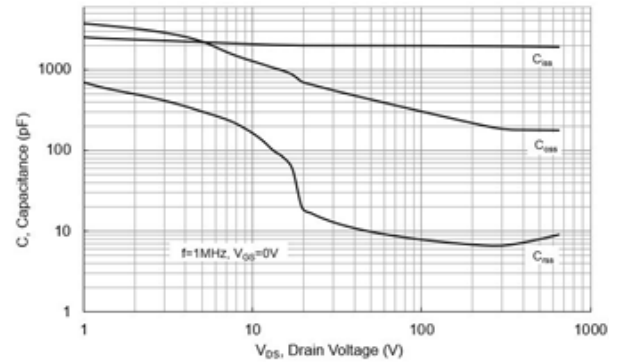


Figure 15. Typical Gate Charge vs. Gate-to-Source Voltage

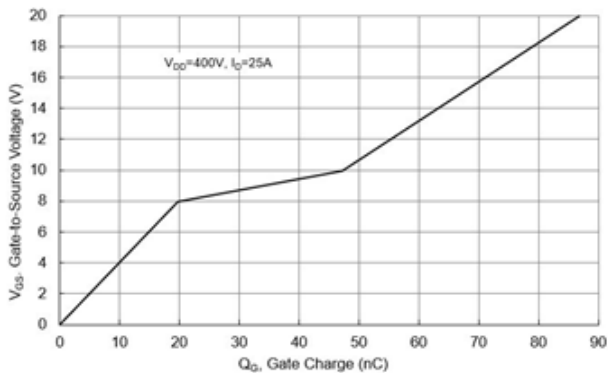


Figure 16. Switching Times vs. R_G

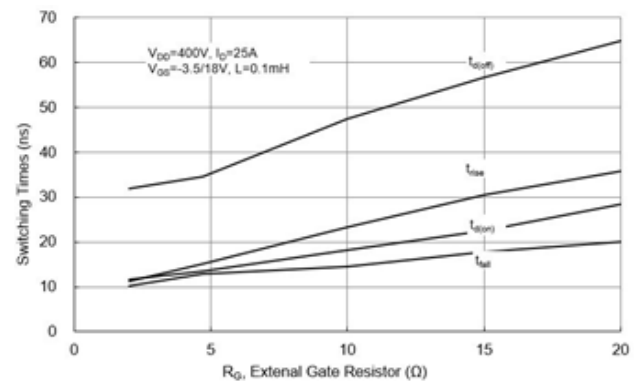


Figure 17. Switching Loss vs. R_G

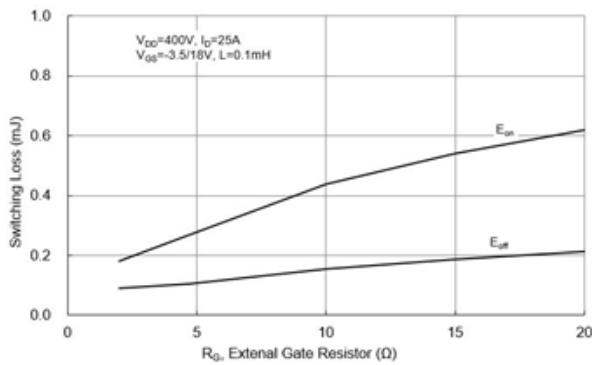


Figure 18. Switching Loss vs. Drain Current

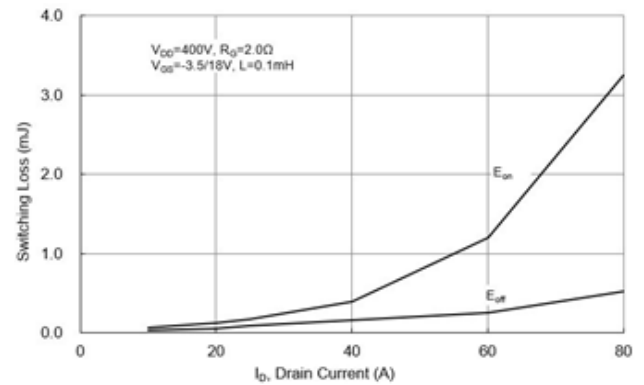


Figure 19. Thermal Impedance Junction-to-Case

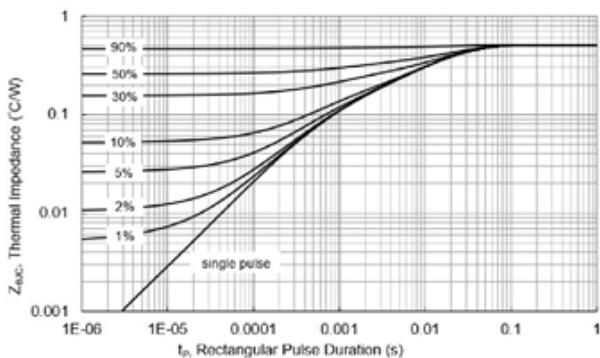


Figure 20. Maximum Peak Current Capability

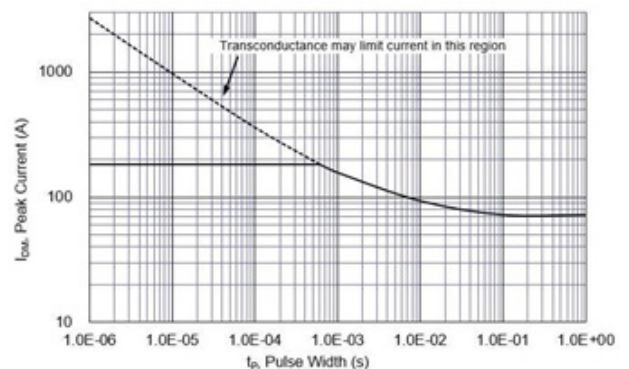


Figure 21. Maximum Power Dissipation vs. Case Temperature

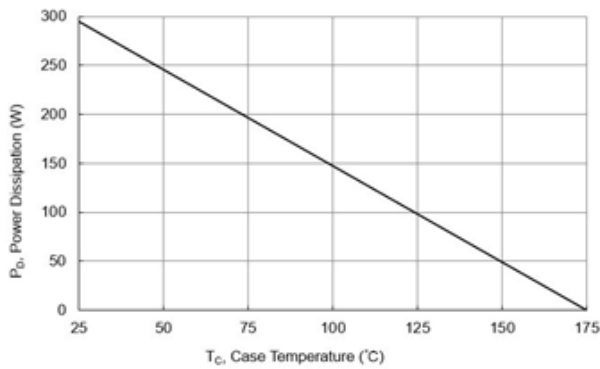


Figure 22. Maximum Continuous Drain Current vs. Case Temperature

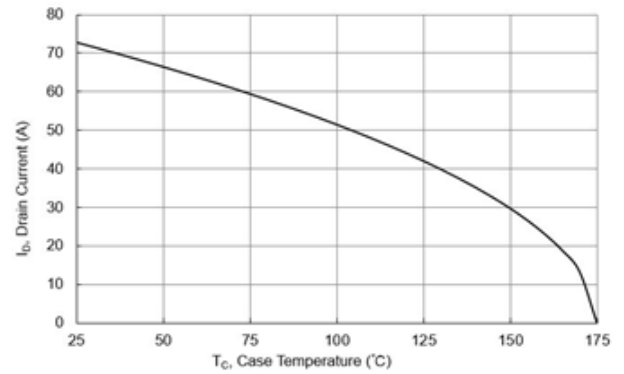
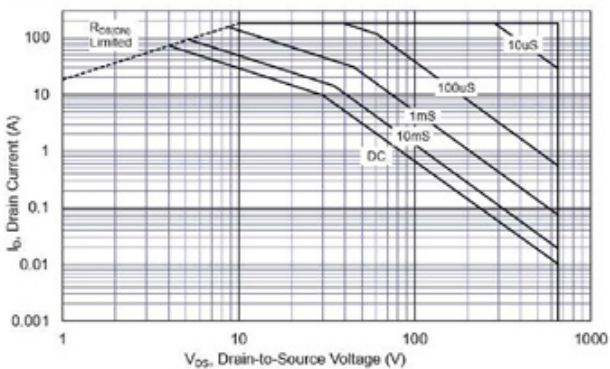


Figure 23. Maximum Forward Safe Operation Area

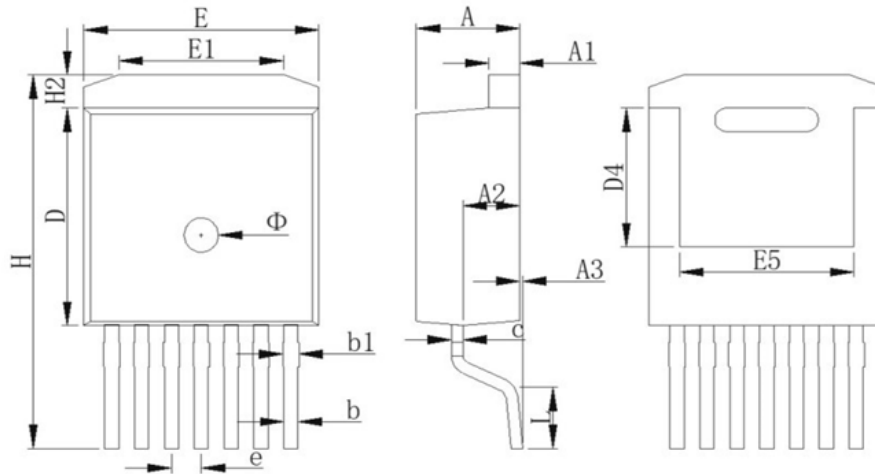


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Package Dimensions

TO-263-7L



| SYMBOL | MM | | | INCH | | |
|--------|---------|--------|--------|----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 4.300 | 4.430 | 4.560 | 0.169 | 0.174 | 0.180 |
| A1 | 1.200 | 1.300 | 1.400 | 0.047 | 0.051 | 0.055 |
| A2 | 2.450 | 2.600 | 2.750 | 0.096 | 0.102 | 0.108 |
| A3 | 0.000 | 0.130 | 0.250 | 0.000 | 0.005 | 0.010 |
| b | 0.500 | 0.600 | 0.700 | 0.020 | 0.024 | 0.028 |
| b1 | 0.600 | 0.700 | 0.900 | 0.024 | 0.028 | 0.035 |
| c | 0.450 | 0.500 | 0.600 | 0.018 | 0.020 | 0.024 |
| D | 8.930 | 9.080 | 9.230 | 0.352 | 0.357 | 0.363 |
| D4 | 4.650 | 4.800 | 4.950 | 0.183 | 0.189 | 0.195 |
| E | 10.080 | 10.180 | 10.280 | 0.397 | 0.401 | 0.405 |
| E1 | 6.500 | 7.000 | 7.500 | 0.256 | 0.276 | 0.295 |
| E5 | 6.820 | 7.220 | 7.620 | 0.269 | 0.284 | 0.300 |
| e | 1.27BSC | | | 0.050BSC | | |
| H | 15.000 | 15.500 | 16.000 | 0.591 | 0.610 | 0.630 |
| H2 | 0.980 | 1.200 | 1.420 | 0.039 | 0.047 | 0.056 |
| L | 1.900 | 2.200 | 2.500 | 0.075 | 0.087 | 0.098 |
| L1 | 6.480 | 6.780 | 7.080 | 0.255 | 0.267 | 0.279 |
| Φ | 1.400 | 1.500 | 1.600 | 0.055 | 0.059 | 0.063 |