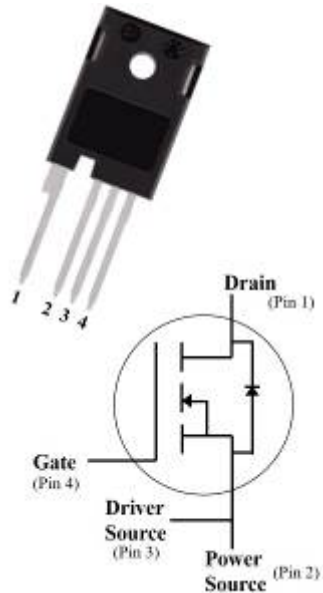


Silicon Carbide Power MOSFET (N-Channel Enhancement)

| | |
|--------------|------|
| V_{DS} | 650V |
| I_D (25°C) | 60A |
| $R_{DS(on)}$ | 25mΩ |



Features

- High speed switching
- Essentially no switching losses
- Reduction of heat sink requirements
- Maximum working temperature at 175 °C
- High blocking voltage
- Fast Intrinsic diode with low recovery current
- High-frequency operation
- Halogen free, RoHS compliant

Typical Applications

Typical applications are in power factor correction (PFC), solar inverter, uninterruptible power supply, motor drives, photovoltaic inverter, electric car and charger.

Mechanical Data

- **Package:** TO247-4L
- **Terminals:** Tin plated leads
- **Polarity:** As marked

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

| PARAMETER | SYMBOL | UNIT | VALUE | TEST CONDITIONS | NOTE |
|--|-----------------|------------------|-------------|---|--------|
| Device marking code | | | | D206525NCFGG2 | |
| Drain source voltage @ $T_j=25^\circ\text{C}$ | $V_{DS,max}$ | V | 650 | $V_{GS}=0\text{ V}$, $I_D=100\mu\text{A}$ | |
| Gate source voltage @ $T_j=25^\circ\text{C}$ | $V_{GS,max}$ | V | -8/+22 | Absolute maximum values | |
| Gate source voltage @ $T_j=25^\circ\text{C}$ | $V_{GS,op}$ | V | -5/+18 | Recommended operational values | |
| Continuous drain current @ $T_c=25^\circ\text{C}$ | I_D | A | 60 | $V_{GS}=20\text{V}$, $T_c=25^\circ\text{C}$ | Fig.17 |
| Continuous drain current @ $T_c=100^\circ\text{C}$ | | | 40 | $V_{GS}=20\text{V}$, $T_c=100^\circ\text{C}$ | |
| Pulsed drain current | $I_{D(pulsed)}$ | A | 130 | Pulse width t_p limited by $T_{j,max}$ | |
| Power Dissipation | P_{TOT} | W | 187 | $T_c=25^\circ\text{C}$, $T_j = 175^\circ\text{C}$ | Fig.16 |
| Power Dissipation | | | 93 | $T_c=100^\circ\text{C}$, $T_j = 175^\circ\text{C}$ | |
| Operating junction and Storage temperature range | T_j, T_{stg} | $^\circ\text{C}$ | -55 to +175 | | |
| Soldering temperature | T_L | $^\circ\text{C}$ | 260 | 1.6mm (0.063") from case for 10s | |
| Mounting torque | T_M | Nm | 0.6 | M3 screw Maximum of mounting process: 3 | |



YJD206525NCFG2

■Static Electrical Characteristics (Tc=25°C unless otherwise specified)

| PARAMETER | SYMBOL | UNIT | Min. | Typ. | Max. | Test Conditions | Note |
|--|---------------|------|------|------|------|--|-------------|
| Gate threshold voltage | $V_{GS(th)}$ | V | 2.0 | 3.2 | 4.0 | $V_{DS}=V_{GS}, I_D=10mA, T_j=25^\circ C$ | Fig.4, 11 |
| | | | | 2.0 | | $V_{DS}=V_{GS}, I_D=10mA, T_j=175^\circ C$ | |
| Drain source breakdown voltage | $V_{(BR)DSS}$ | V | 650 | | | $V_{GS}=0V, I_D=100\mu A$ | |
| Gate source leakage current | I_{GSS} | nA | | 50 | 200 | $V_{GS}=20V, V_{DS}=0V$ | |
| Current drain source on-state resistance | $R_{DS(on)}$ | mΩ | | 25 | 40 | $V_{GS}=18V, I_D=20A, T_j=25^\circ C$ | Fig.5, 6, 7 |
| | | | | 30 | | $V_{GS}=18V, I_D=20A, T_j=175^\circ C$ | |
| Internal gate resistance | R_g | Ω | | 1.5 | | $f=1MHz, V_{AC}=25mV$ | |
| Transconductance | g_{fs} | S | | 20 | | $V_{DS}=20V, I_D=20A, T_j=25^\circ C$ | Fig.4 |
| | | | | 18 | | $V_{DS}=20V, I_D=20A, T_j=175^\circ C$ | |

■Dynamic Electrical Characteristics (Tc=25°C unless otherwise specified)

| PARAMETER | SYMBOL | UNIT | Min. | Typ. | Max. | Test Conditions | Note |
|---------------------|-----------|------|------|------|------|---|------------|
| Input capacitance | C_{iss} | pF | | 2900 | | $V_{DS}=400V, V_{GS}=0V, T_j=25^\circ C, f=1MHz, V_{AC}=25mV$ | Fig.13, 14 |
| Output capacitance | C_{oss} | | | 118 | | | |
| Reverse capacitance | C_{rss} | | | 11.6 | | | |
| Coss stored energy | E_{oss} | uJ | | 35 | | | Fig.15 |
| Gate source charge | Q_{gs} | nC | | 38 | | $V_{DD}=400V, V_{GS}=-5/18V, I_D=20A$ | Fig.12 |
| Gate drain charge | Q_{gd} | | | 39 | | | |
| Gate charge | Q_g | | | 137 | | | |

■Switching Characteristics (Tc=25°C unless otherwise specified)

| PARAMETER | SYMBOL | UNIT | Min. | Typ. | Max. | Test Conditions | Note |
|---------------------------|--------------|------|------|------|------|---|-------------|
| Turn on switching energy | E_{on} | mJ | | 1.6 | | $V_{DS}=400V, V_{GS}=-5/+18V, I_D=20A, R_g=5\Omega, L=142\mu H$ | Fig. 19, 20 |
| Turn off switching energy | E_{off} | | | 0.8 | | | |
| Turn on delay time | $t_{d(on)}$ | ns | | 18 | | $V_{DD}=400V, V_{GS}=-5/+18V, I_D=20A, R_g=5\Omega, L=142\mu H$ | Fig.21 |
| Rise time | t_r | | | 11 | | | |
| Turn off delay time | $t_{d(off)}$ | | | 30 | | | |
| Fall time | t_f | | | 5 | | | |



YJD206525NCFG2

■Body diode characteristics (Tc=25°C unless otherwise specified)

| PARAMETER | SYMBOL | UNIT | Min. | Typ. | Max. | Test Conditions | Note |
|----------------------------------|-----------------|------|------|------|------|--|-------|
| Diode forward voltage | V _{SD} | V | | 3.6 | | V _{GS} =-5V, I _{SD} =15A, T _J =25°C | Fig.8 |
| | | | | 2.5 | | V _{GS} =0V, I _{SD} =15A, T _J =175°C | Fig.9 |
| Continuous diode forward current | I _S | A | | 60 | | T _C =25°C | |
| Reverse recovery time | trr | nS | | 30 | | V _R =400V, V _{GS} =-5V, I _{SD} =15A, di/dt=1200A/us | |
| Reverse recovery charge | Qrr | nC | | 120 | | | |
| Peak reverse recovery current | Irrm | A | | 10 | | | |

■Thermal Characteristics (T_a=25°C Unless otherwise specified)

| PARAMETER | SYMBOL | UNIT | Typ. |
|--------------------|-------------------|------|------|
| Thermal resistance | R _{θJ-C} | °C/W | 0.8 |

■Typical Characteristics

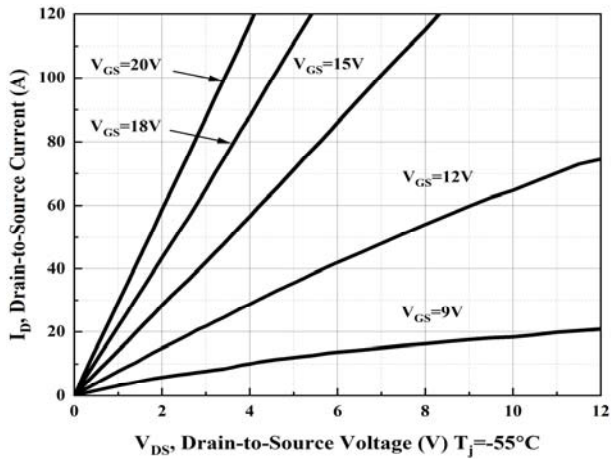


Figure 1. Output Characteristics T_J = -55°C

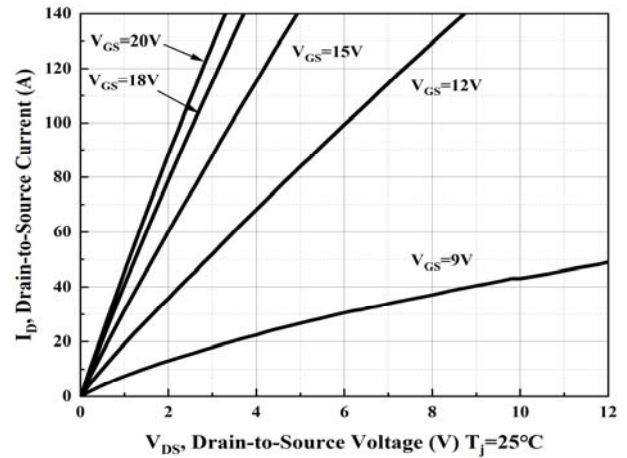


Figure2. Output Characteristics T_J = 25°C

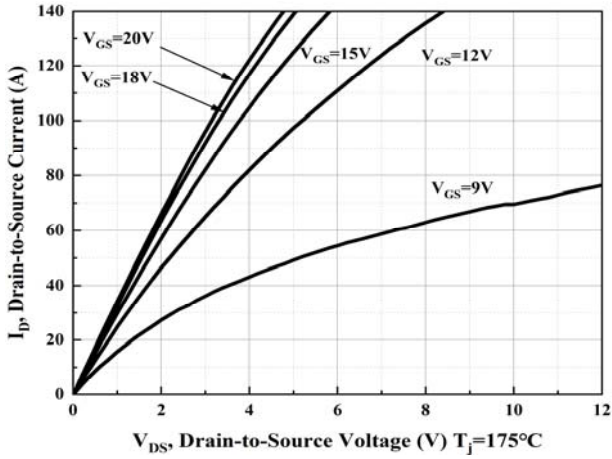


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

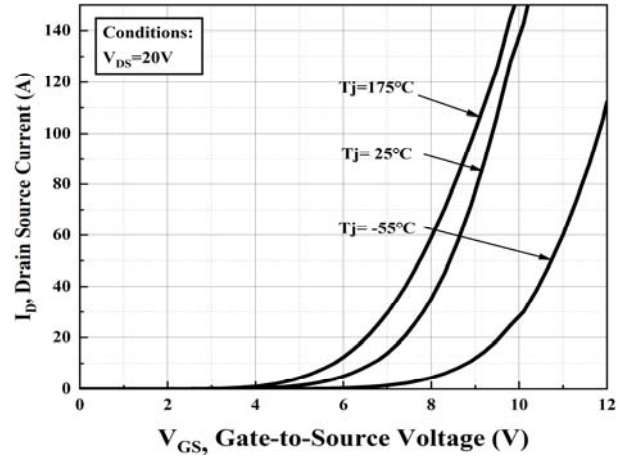


Figure 4. Transfer Characteristics for Various Junction Temperature

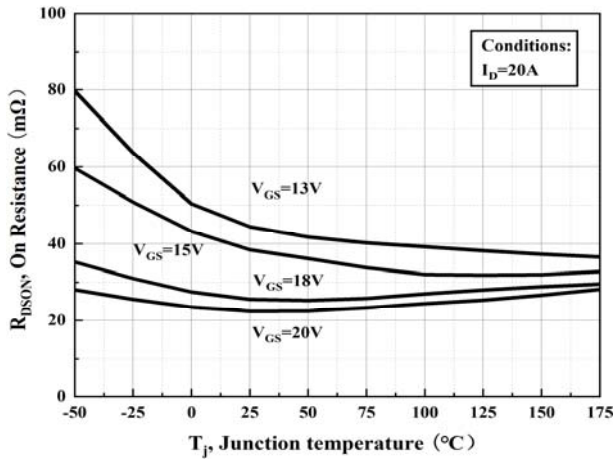


Figure 5. On-resistance vs. Temperature for Various Gate Voltage

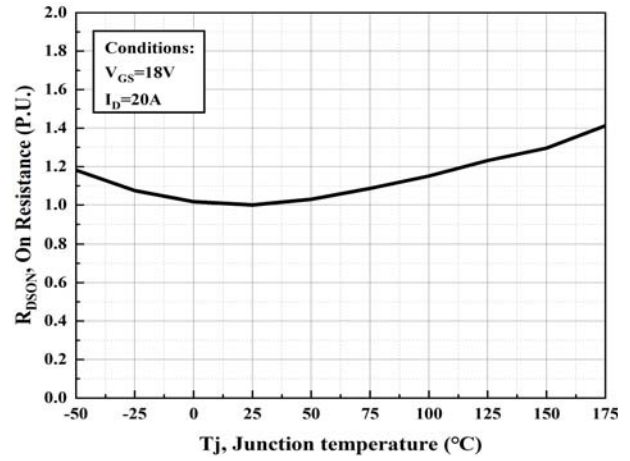


Figure 6. Normalized on-resistance vs. Temperature

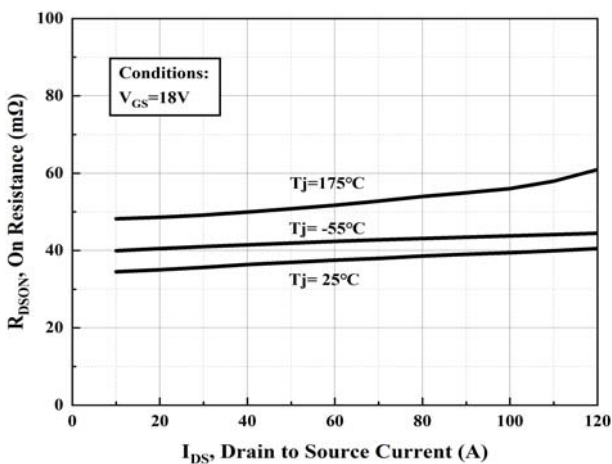


Figure 7. On-resistance vs. Drain Current

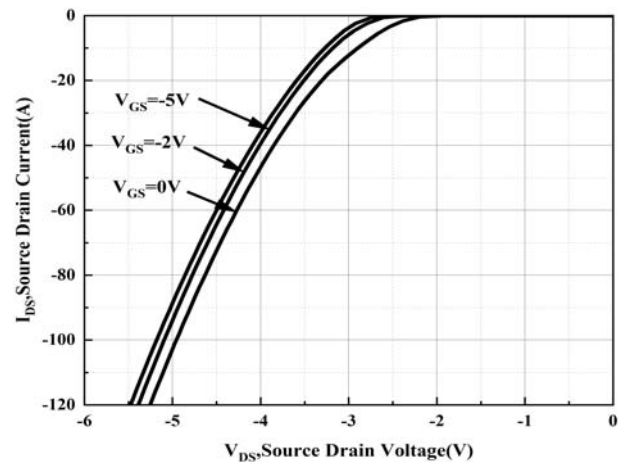


Figure 8. Body Diode Characteristic at $T_j = 25^\circ\text{C}$



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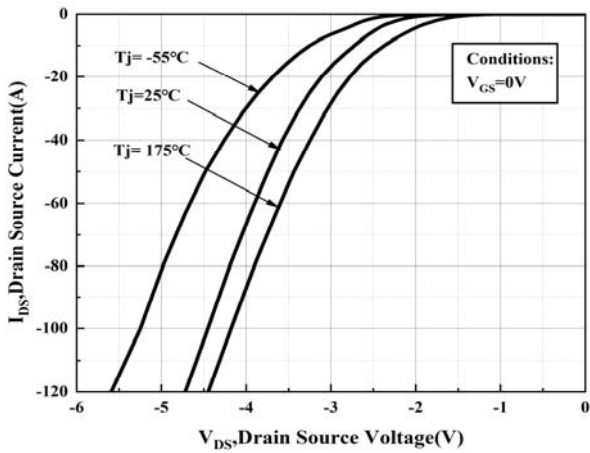


Figure 9. Body Diode Characteristic

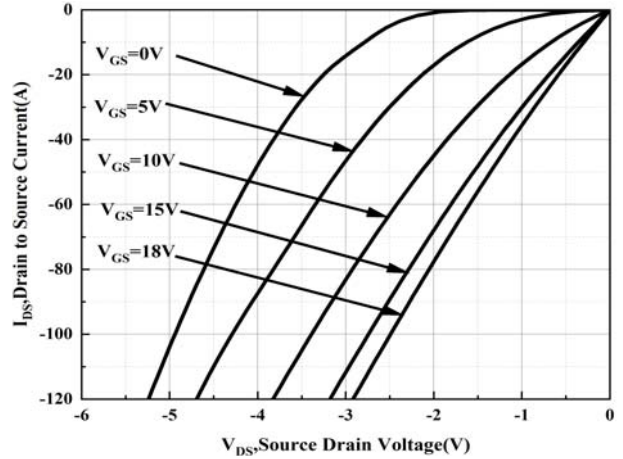


Figure 10. 3rd quadrant Characteristic at $T_j = 25^\circ\text{C}$

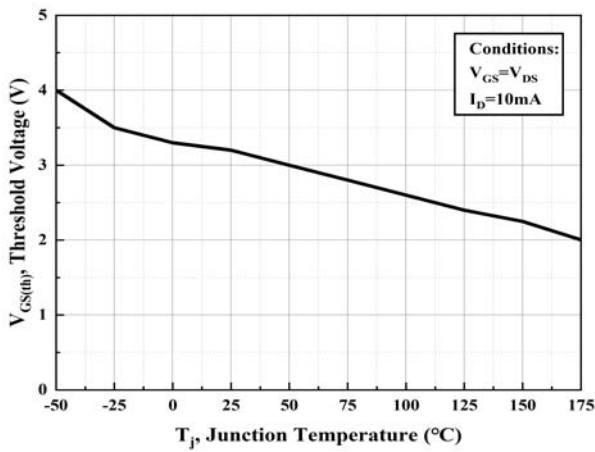


Figure 11. Threshold Voltage vs. Temperature

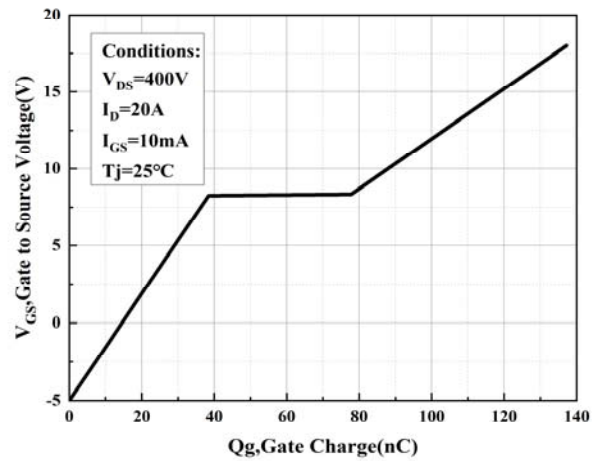


Figure 12. Gate Charge Characteristic

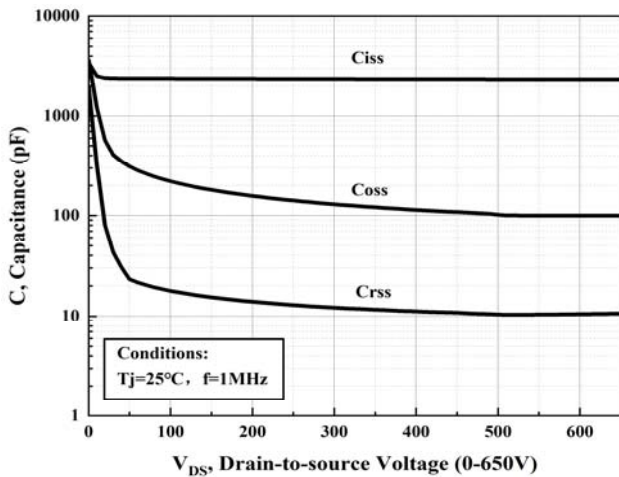


Figure 13. Capacitances vs. Drain Source Voltage (0-650V)

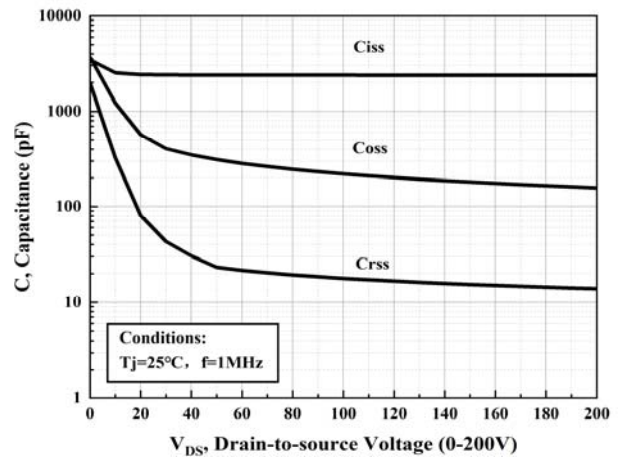


Figure 14. Capacitances vs. Drain Source Voltage (0-200V)



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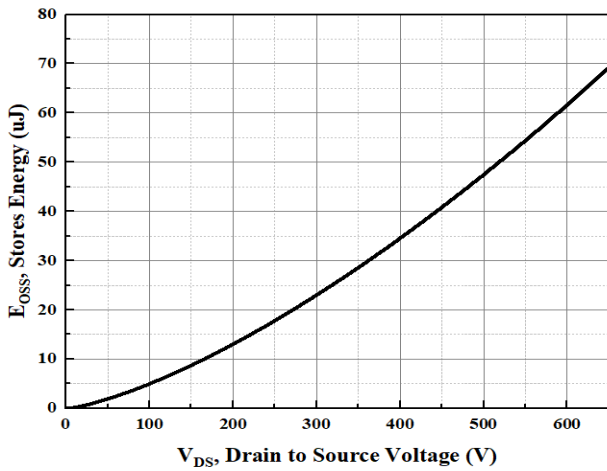


Figure 15. Output Capacitor Stored Energy

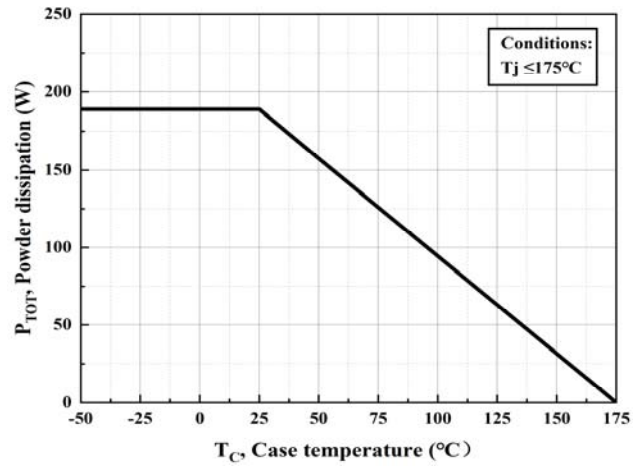


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

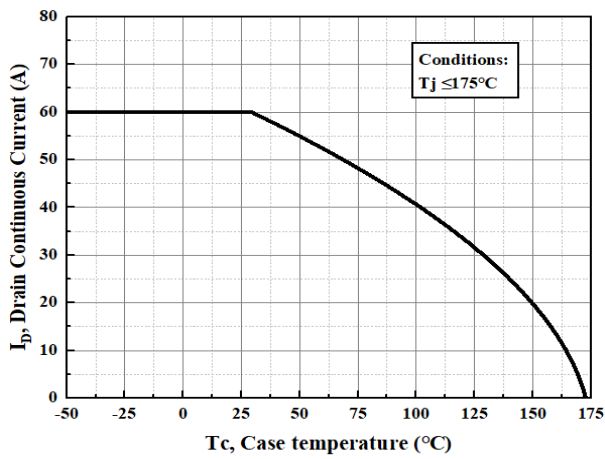


Figure 17. Continuous Drain Current Derating vs. Case Temperature

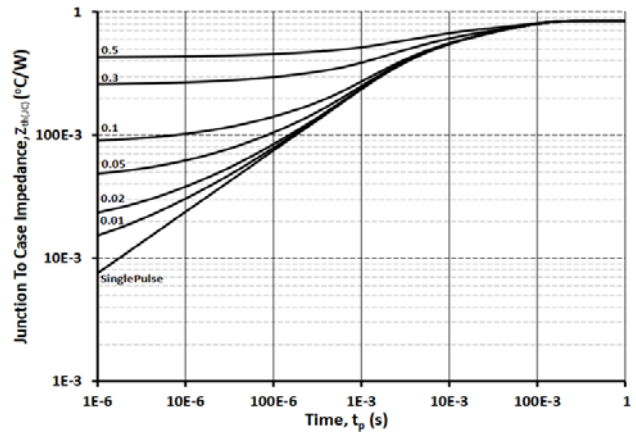


Figure 18. Transient Thermal Impedance (Junction - Case)

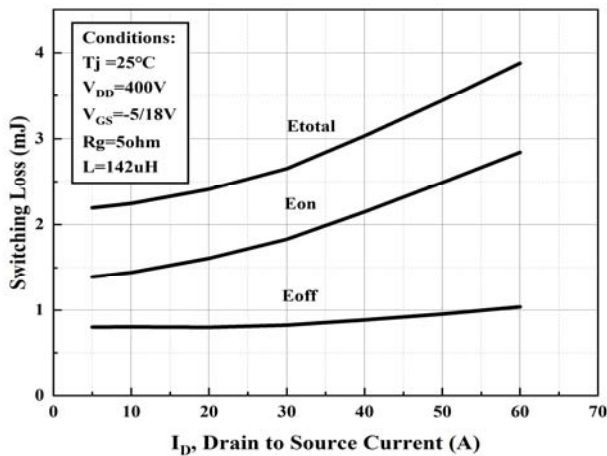


Figure 19. Clamped Inductive Switching Energy vs. Drain Current

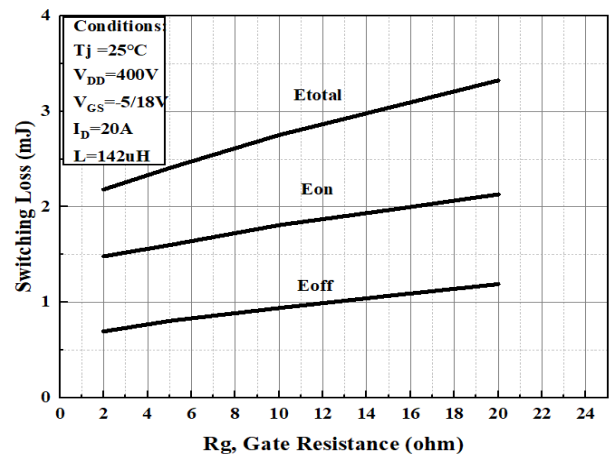


Figure 20. Clamped Inductive Switching Energy vs. Rg

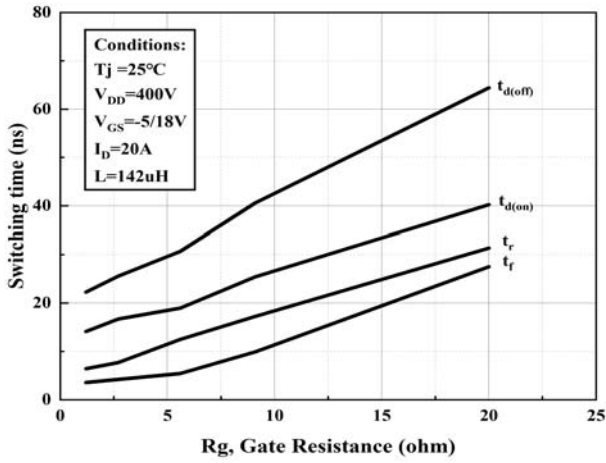


Figure 21. Switching Times vs. R_g

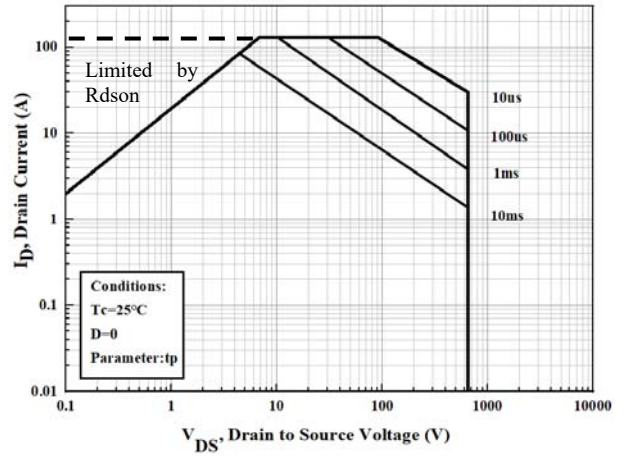


Figure 22. Safe Operating Area

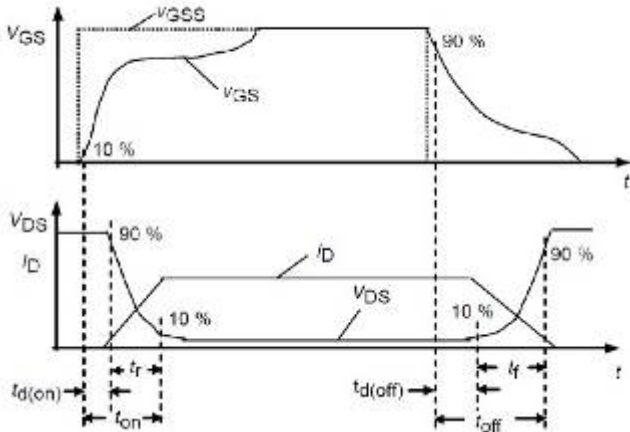


Figure 23. Switching Times Definition

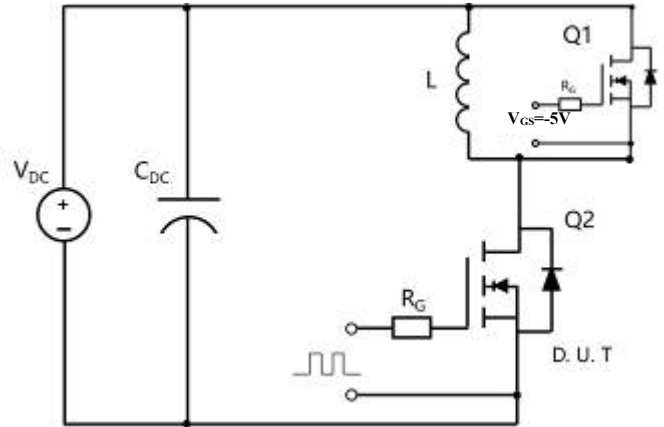
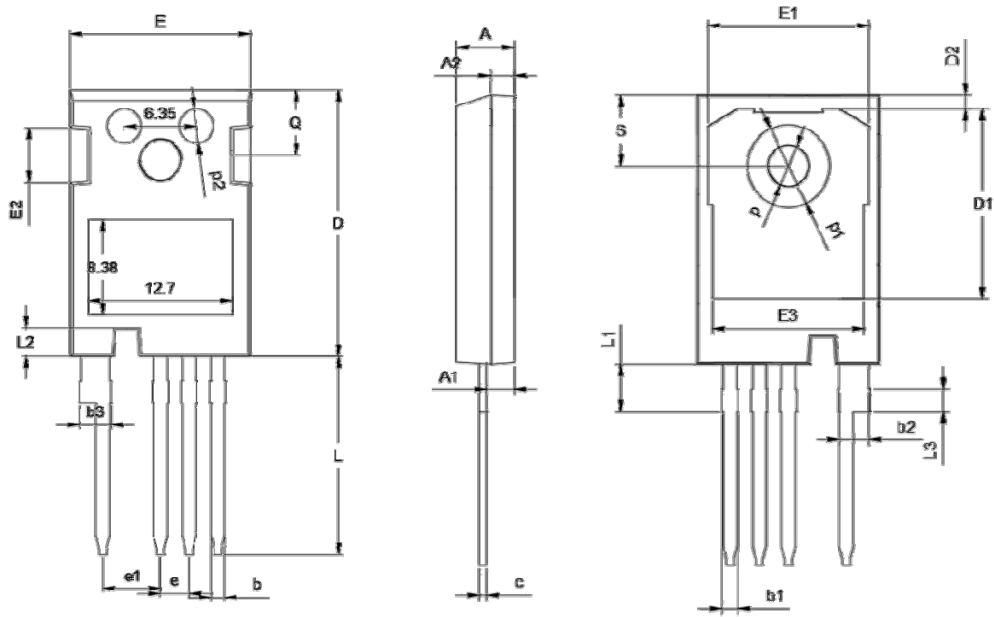


Figure 24. Clamped Inductive Switching Waveform Test Circuit



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■Outline Dimensions



| TO247-4L | | | |
|----------|---------|-------|-------|
| Dim | Min | Norm | Max |
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.30 | 2.40 | 2.50 |
| A2 | 1.88 | 1.98 | 2.08 |
| b | 1.10 | 1.20 | 1.30 |
| b1 | 1.20 | / | 1.50 |
| b2 | 2.35 | 2.55 | 2.75 |
| b3 | 2.45 | / | 2.85 |
| c | 0.55 | 0.60 | 0.65 |
| D | 23.3 | 23.45 | 23.6 |
| D1 | 16.25 | 16.55 | 16.85 |
| D2 | 1.00 | / | 1.30 |
| e | TYP2.54 | | |
| e1 | TYP5.06 | | |
| E | 15.75 | 15.90 | 16.05 |
| E1 | 13.80 | / | 14.20 |
| E2 | 4.40 | 4.75 | 5.10 |
| E3 | 13.00 | / | 13.45 |
| L | 17.34 | 17.49 | 17.64 |
| L1 | 4.00 | / | 4.30 |
| L2 | 2.35 | / | 2.65 |
| L3 | TYP1.98 | | |
| Q | 5.60 | 5.80 | 6.00 |
| S | 6.05 | / | 6.30 |
| p | TYP3.58 | | |
| p1 | TYP7.18 | | |
| p2 | TYP3.00 | | |



YJD206525NCFG2

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