DACO

# DAC023N065LY3

## Silicon Carbide Enhancement Mode MOSFET

| | |
|---|---|
| $V_{DSS}$ | 650V |
| $I_{D(@25℃)}$ | 96A |
| $R_{DS(ON)}$ typ. | 22.5mΩ |

## Features

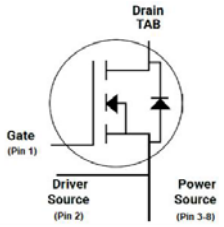
- High blocking voltage with low Rds(on)
- High frequency operation with low Capacitance
- Simple to drive with -4V/+18V gate
- Robust body diode with low Qrr
- 100% Avalanche tested

## Benefits

- Superior robustness and system reliability
- Higher system efficiency
- Easier paralleling without thermal runaway
- Capable of high temperature application
- Faster and more efficient switching

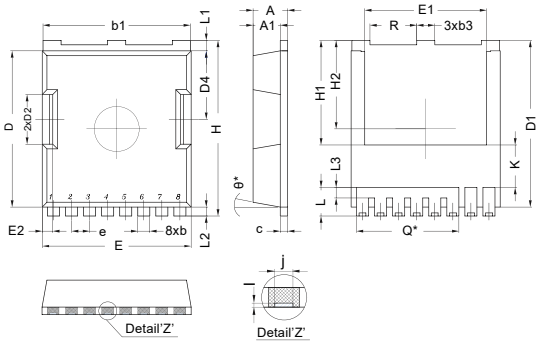
## Applications

- Server power
- EV/HEV charging station
- Energy storage systems
- High performance DC-DC converters
- On-board charger
- Battery management systems





Package Dimensions




## Absolute Maximum Ratings

(Tc = 25℃ unless otherwise specified)

| Parameter | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{GS}$=0V<br>$I_D$=100μA | $V_{DS}$ | 650 | V |
| Gate-Source Voltage (dynamic) | AC (f>1 Hz,<br>duty cycle<1%,<br>pulse width<200ns) | $V_{GS}$ | -9/+23 | V |
| Gate-Source Voltage (static) | | $V_{GS(op)}$ | -4/+18 | V |
| Drain Current-Continuous | @ $T_C$=25°C<br>@ $T_C$=100°C | $I_D$ | 96<br>66 | A |
| Pulse Drain Current | | $I_{D,pulse}$ | 220 | A |
| Power Dissipation | | $P_D$ | 325 | W |
| Storage Temperature Range | | $T_{STG}$ | -55 to +175 | °C |
| Operating Junction Temperature Range | | $T_J$ | -55 to +175 | °C |
| Soldering Temperature | | $T_L$ | 260 | °C |
| Avalanche Capability, single pulse * | $V_{DD}$=100V<br>$V_{GS}$=10V<br>L=2mH | $I_{AV}$ | 36 | A |
| Avalanche Capability, single pulse** | $V_{DD}$=100V<br>$V_{GS}$=10V<br>L=2mH | $E_{AV}$ | 1200 | mJ |

* 100% tested in 60% rating
** 100% tested in 36% rating

| SYMBOL | DIMENSIONS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 2.20 | 2.30 | 2.40 |
| A1 | 1.70 | 1.80 | 1.90 |
| b | 0.70 | 0.80 | 0.90 |
| b1 | 9.70 | 9.80 | 9.90 |
| b3 | 1.10 | 1.20 | 1.30 |
| c | 0.40 | 0.50 | 0.60 |
| D | 10.28 | 10.38 | 10.48 |
| D1 | 10.98 | 11.08 | 11.18 |
| D2 | 3.20 | 3.30 | 3.40 |
| D4 | 4.45 | 4.55 | 4.65 |
| E | 9.80 | 9.90 | 10.00 |
| E1 | 8.00 | 8.10 | 8.20 |
| E2 | 0.60 | 0.70 | 0.80 |
| e | | 1.20 BSC | |
| H | 11.58 | 11.68 | 11.78 |
| H1 | | 6.95 BSC | |
| H2 | | 5.89 BSC | |
| I | | 0.10 REF. | |
| j | | 0.46 REF. | |
| K | | 2.80 REF. | |
| L | 1.40 | 1.90 | 2.10 |
| L1 | 0.60 | 0.70 | 0.80 |
| L2 | 0.50 | 0.60 | 0.70 |
| L3 | 0.30 | 0.70 | 0.80 |
| N | | 8 | |
| Q | | 6.80 REF. | |
| R | 3.00 | 3.10 | 3.20 |
| θ | | 10° REF. | |

NOTE:
1. REFER TO JEDEC MO-299B.
2. All DIMENSIONS ARE IN MM, ANGLES IN DEGREES.
3. DIMENSIONS DO NOT INCLUSIVE BURRS AND MOLD FLASH.
4. "*" IS FOR REFERENCE.

## Electrical Characteristics @ $T_C$ =25°C (unless otherwise specified)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **OFF Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ =0V，$I_D$ =0.1mA | 650 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ =650V，$V_{GS}$ =0V | - | 0.5 | 60 | μA |
| | | $V_{DS}$ =650V，$V_{GS}$ =0V，$T_J$ =175°C | - | 5 | 200 | |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$ =18V，$V_{DS}$ =0V | - | 5 | 100 | nA |
| | | $V_{GS}$ =-4V，$V_{DS}$ =0V | -100 | -5 | - | |
| **ON Characteristics** | | | | | | |
| Gate Threshold Voltage ** | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$，$I_D$ =10mA | 2.6 | 3.1 | 4.2 | V |
| | | $V_{DS}$ = $V_{GS}$，$I_D$ =10mA，$T_J$ =150°C | - | 2.2 | - | |
| | | $V_{DS}$ = $V_{GS}$，$I_D$ =10mA，$T_J$ =175°C | - | 2.1 | - | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$ =18V，$I_D$ =30A | - | 22.5 | 28.5 | mΩ |
| | | $V_{GS}$ =18V，$I_D$ =30A，$T_J$ =175°C | - | 27 | - | |
| Transconductance | $g_{fs}$ | $V_{DS}$ =20V，$I_D$ =30A | - | 23 | - | S |
| | | $V_{DS}$ =20V，$I_D$ =30A，$T_J$ =175°C | - | 21 | - | |
| Internal Gate Resistance | $R_{G(int.)}$ | f =1MHz，$I_D$ =0A | - | 1.2 | - | Ω |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ =400V<br>$V_{GS}$ =0V<br>Freq.=1MHz<br>$V_{AC}$ =25mV | - | 2400 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 190 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 8 | - | |
| C oss Stored Energy | $E_{oss}$ | | - | 19 | - | μJ |
| Turn-On Switching Energy | $E_{on}$ | $V_{DS}$ =400V，$V_{GS}$ =-4/+18V<br>$I_D$ =30A，$R_{G(ext)}$ =2.0Ω<br>L=200μH | - | 29 | - | μJ |
| Turn-Off Switching Energy | $E_{off}$ | | - | 26 | - | |
| **Switching Characteristics** | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DS}$ =400V，$V_{GS}$ =-4/+18V<br>$I_D$ =30A，$R_{G(ext)}$ =2.0Ω<br>L=200μH | - | 15 | - | ns |
| Rise Time | $t_r$ | | - | 11 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 29 | - | |
| Fall Time | $t_f$ | | - | 6 | - | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ =400V<br>$V_{GS}$ =-4/+18V<br>$I_D$ =30A | - | 112 | - | nC |
| Gate to Source Charge | $Q_{gs}$ | | - | 30 | - | |
| Gate to Drain Charge | $Q_{gd}$ | | - | 45 | - | |
| **Body Diode Characteristics** | | | | | | |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=-4V，$I_{SD}$=20A，$T_J$ =25°C | - | 3.3 | - | V |
| | | $V_{GS}$=-4V，$I_{SD}$=20A，$T_J$ =175°C | - | 3.0 | - | |
| Continuous Diode Forward Current | $I_S$ | $V_{GS}$=-4V，$T_J$ =25°C | - | 62 | - | A |
| Reverse Recovery Time | $T_{rr}$ | $I_{SD}$=30A，$V_{GS}$=-4V<br>$V_R$=400V，$R_{G(ext)}$ =20Ω<br>L=200μH，dif/dt=1420A/μs | - | 22 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 240 | - | nC |
| Reverse Recovery Charge | $I_{rrm}$ | | - | 21 | - | A |
| **Thermal Resistance** | | | | | | |
| Thermal Resistance, Junction-to-Case | $R\theta_{JC}$ | | - | 0.46 | 0.55 | °C/W |

** Turn-off with -4V gate bias is highly recommended

## Typical Performance

**Fig 1. Output Characteristics, $T_J$ = -40°C**

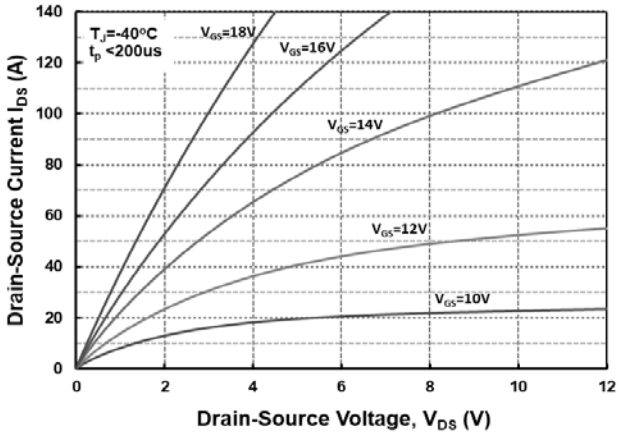



**Fig 2. Output Characteristics, $T_J$ = 25°C**

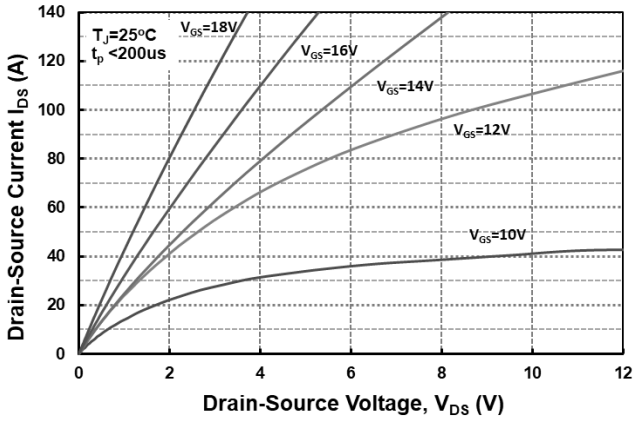



**Fig 3. Output Characteristics at $T_J$ =175℃**

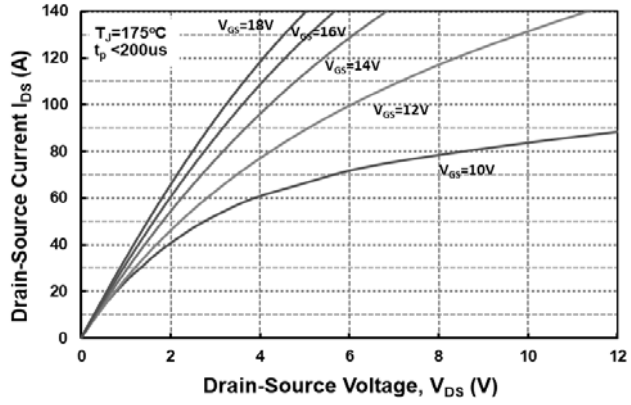



**Fig 4. Normalized On-Resistance vs. Temperature**

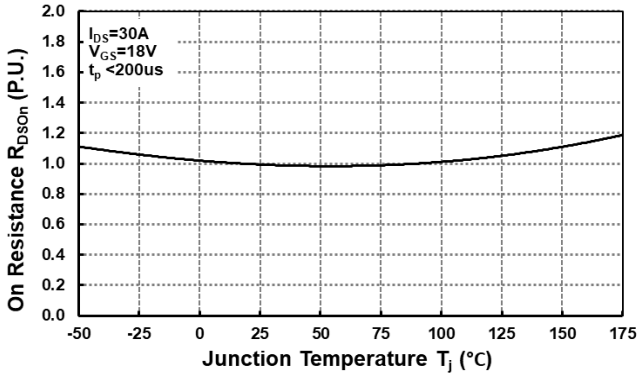



**Fig 5. On-Resistance vs. Drain Current for Various Temperatures**

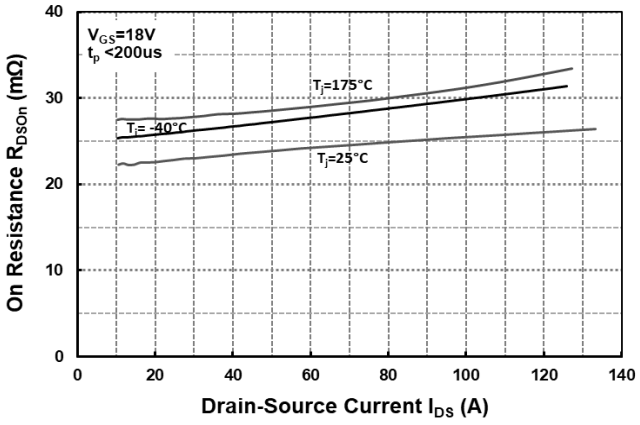
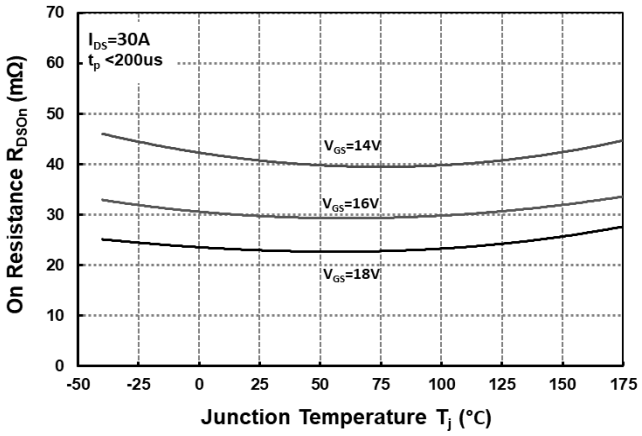



**Fig 6. On-Resistance vs. Temperature for Various Gate Voltage**



## Typical Performance

**Fig 7. Transfer Characteristic for Various Junction Temperatures**

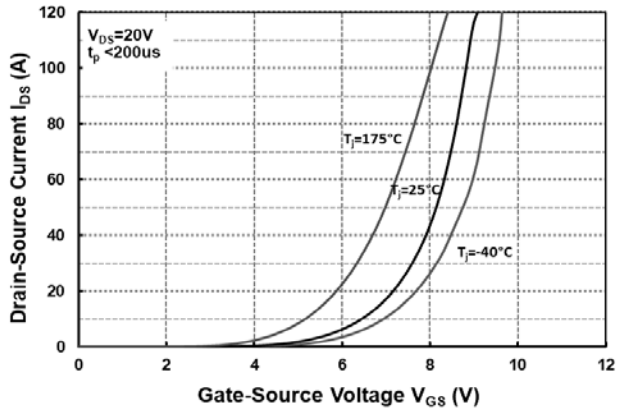



**Fig 8. Body Diode Characteristics @ -40°C**

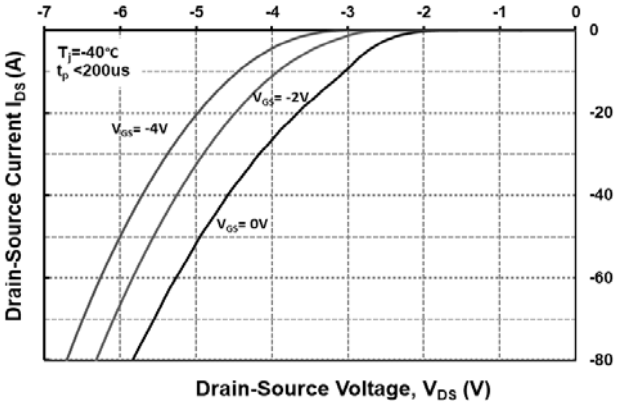



**Fig 9. Body Diode Characteristics @ 25°C**

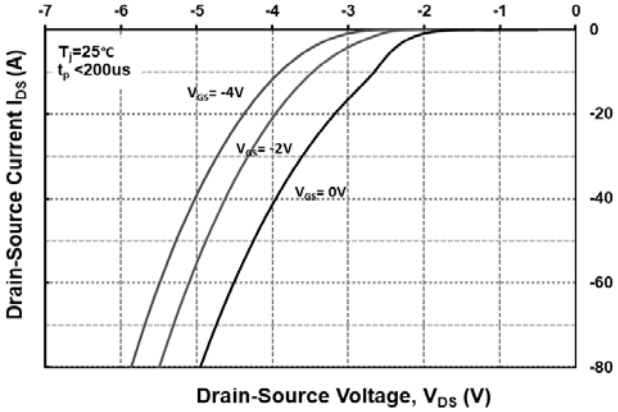



**Fig 10. Body Diode Characteristics @ 175°C**

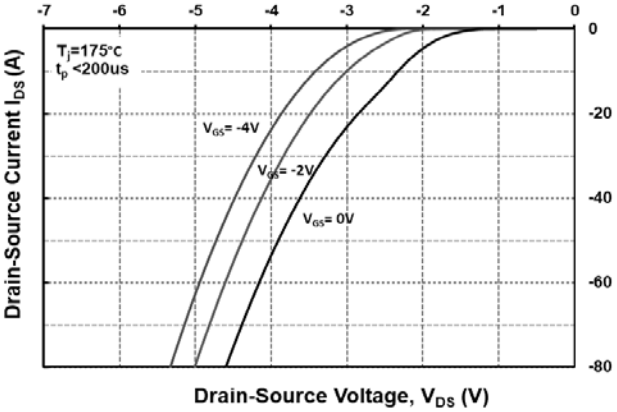



**Fig 11. Threshold Voltage vs. Temperature**

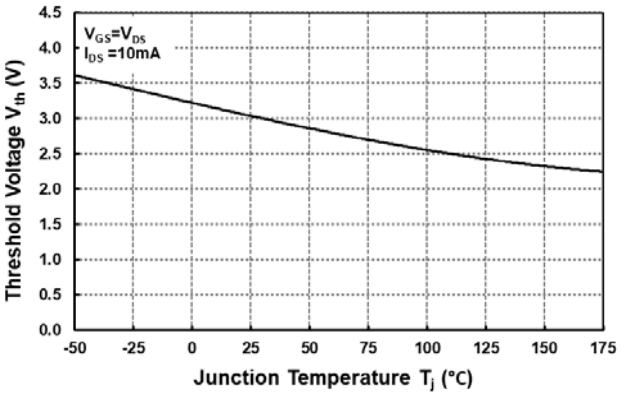
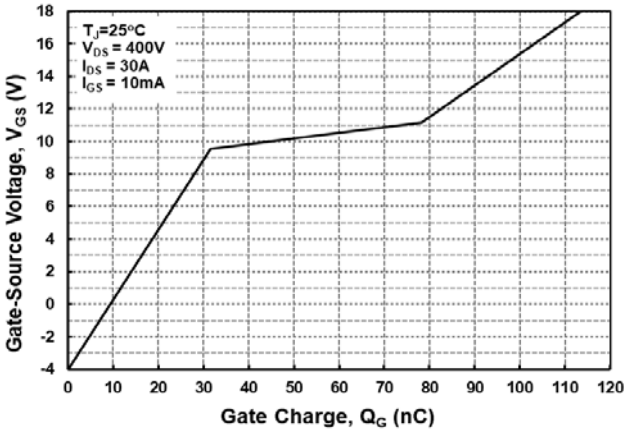



**Fig 12. Gate Charge Characteristics**



## Typical Performance

**Fig 13. 3rd Quadrant Characteristics @ -40°C**

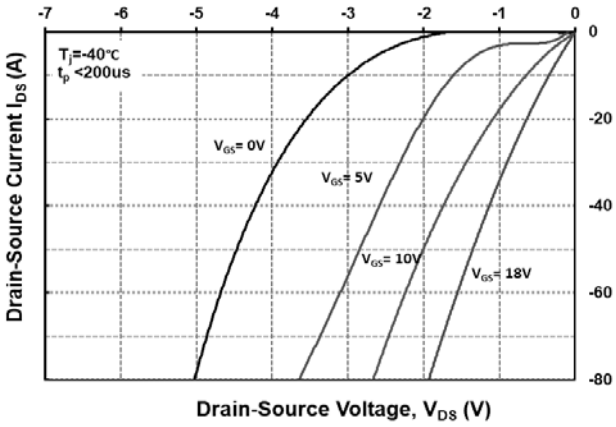



**Fig 14. 3rd Quadrant Characteristics @ 25°C**

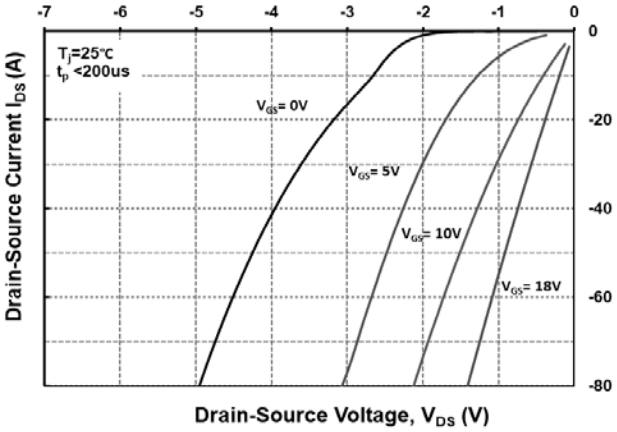



**Fig 15. 3rd Quadrant Characteristics @ 175°C**

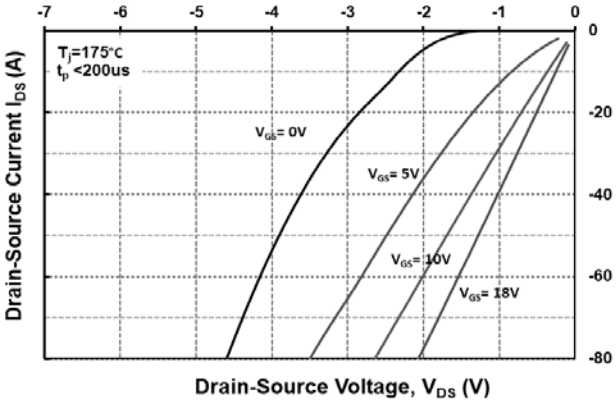



**Fig 16. Output Capacitor Stored Energy**

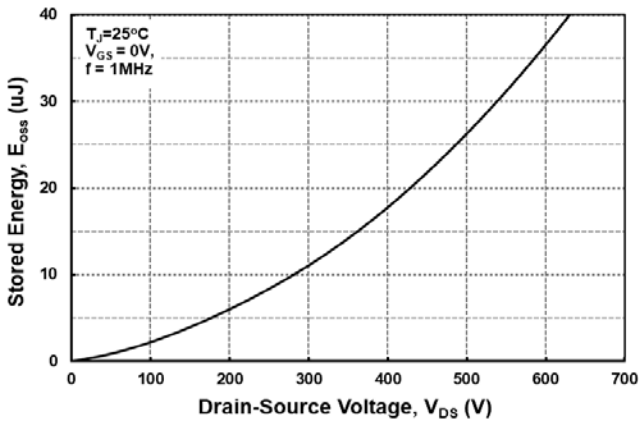



**Fig 17. Capacitances vs. Drain-Source Voltage (0-200V)**

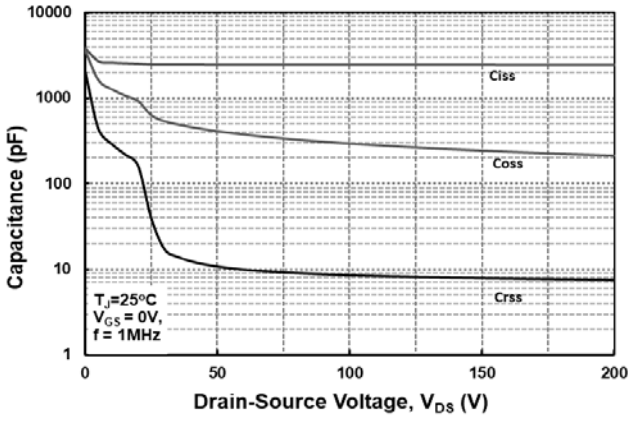
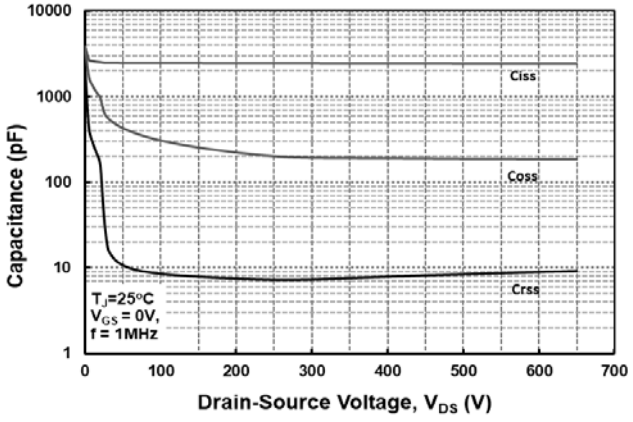



**Fig 18. Capacitances vs. Drain-Source Voltage (0-650V)**



## Typical Performance

**Fig 19. Continuous Drain Current Derating vs. Case Temperature**

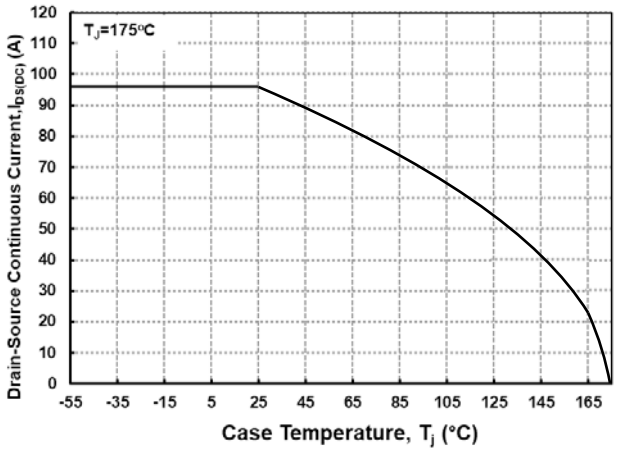



**Fig 20. Maximum Power Dissipation Derating vs. Case Temperature**

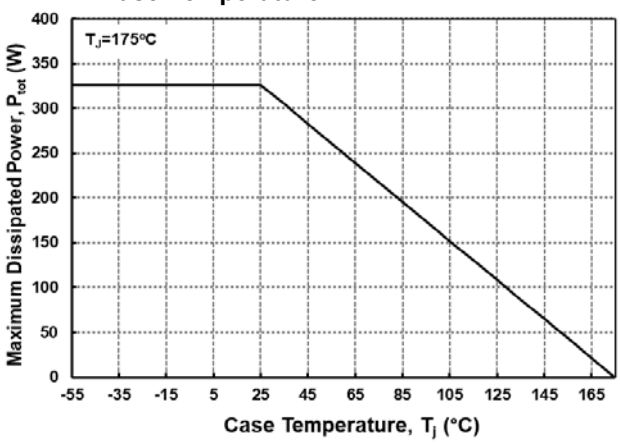



**Fig 21. Transient Thermal Impedance (Junction – Case)**

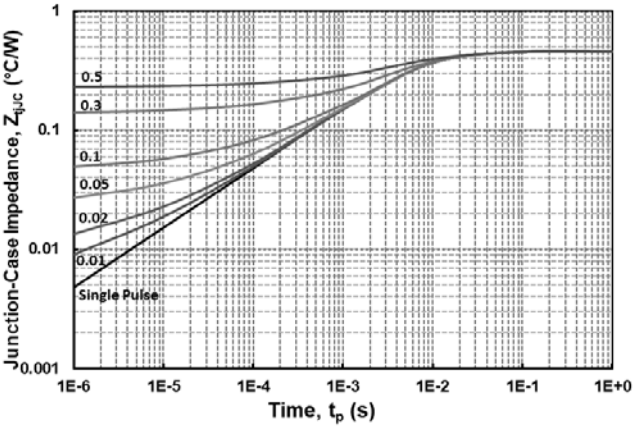



**Fig 22. Safe Operating Area**

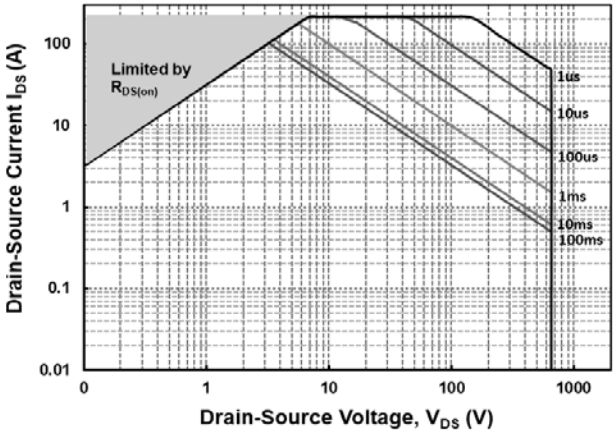



**Fig 23. Clamped Inductive Switching Energy vs Drain Current ($V_{DD}$ = 400V)**

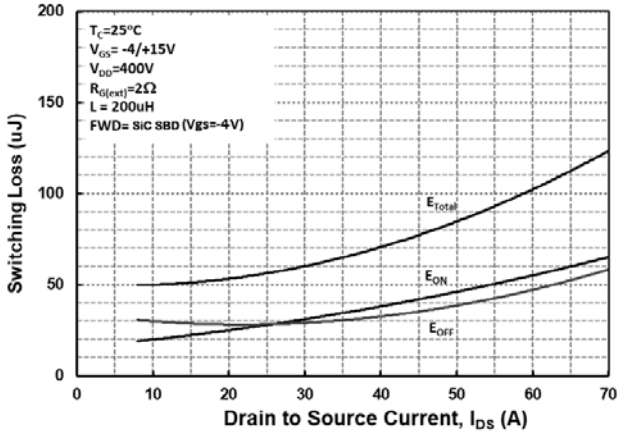
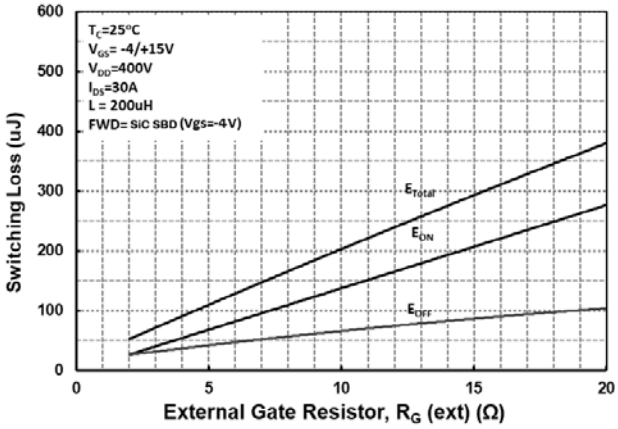



**Fig 24. Clamped Inductive Switching Energy vs External Gate Resistor $R_{G(ext)}$**



## Typical Performance

**Fig 25. Switching Times vs Drain Current ($V_{DD}$ = 400V)**

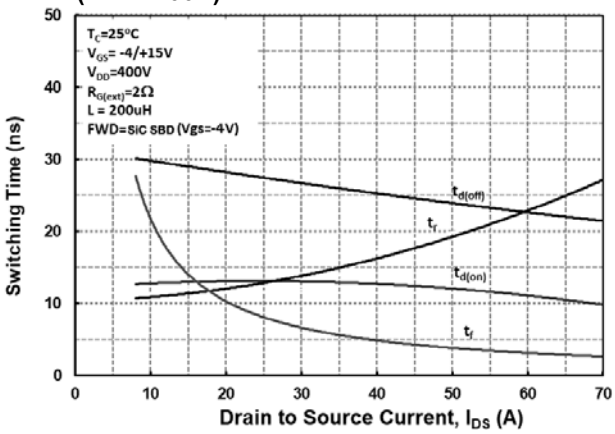
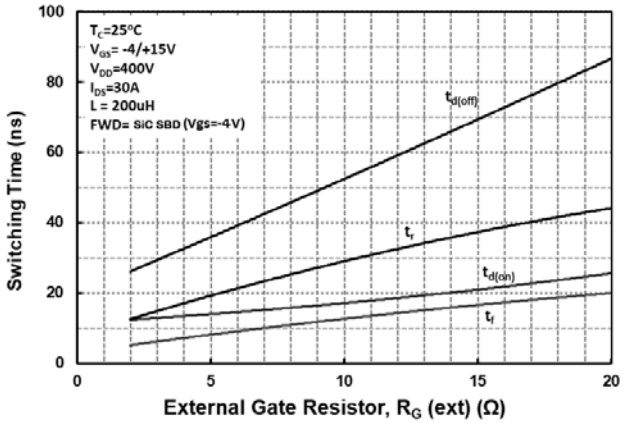



**Fig 26. Switching Times vs External Gate Resistor $R_{G(ext)}$**



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