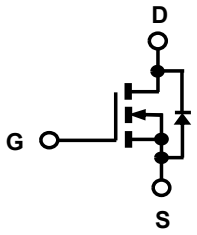
IceMOS Technology

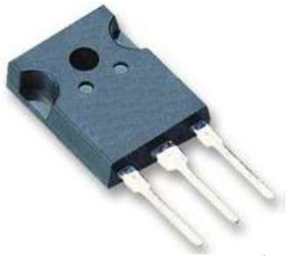
# Preliminary
# ICEK35NF60W

## ICEK35NF60W N-Channel Enhancement Mode MOSFET

| Product Summary | | | |
|---|---|---|---|
| $I_D$ | $T_A$=25°C | 35A | Max |
| $V_{(BR)DSS}$ | $I_D$=1mA | 600V | Min |
| $r_{DS(on)}$ | $V_{GS}$=10V | 56mΩ | Typ |
| $Q_g$ | $V_{DS}$=400V | 83nC | Typ |

### Features
- TO247-3L package
- Ultra Low $r_{DS(on)}$
- Ultra Low Gate Charge
- High d*v*/d*t* capability
- Ultra Fast Recovery Body Diode
- High Unclamped Inductive Switching (UIS) capability
- High peak current capability
- Increased transconductance performance
- Optimized design for high performance power systems




**TO247**
**1:G, 2:D, 3:S**

**(TO-247)**

RoHS COMPLIANT RoHS (EU) 2015/863 CE HALOGEN FREE Pb Lead Free

### *Maximum ratings* [a] at $T_j$=25°C, unless otherwise specified

| *Parameter* | *Symbol* | *Conditions* | *Value* | *Unit* |
|---|---|---|---|---|
| Continuous drain current [b] | $I_D$ | $T_c$=25°C<br>$T_c$=100°C | 35<br>22 | A |
| Pulsed drain current [b] | $I_{D,\ pulse}$ | $T_c$=25°C | 105 | A |
| Avalanche energy, single pulse | $E_{AS}$ | $L$ = 10.8 mH, $V_{DD}$ = 150 V, $I_{AS}$ = 7 A, $R_G$ = 50 Ω | 264.5 | mJ |
| Avalanche current, repetitive [b] | $I_{AR}$ | limited by $T_j$max | 7 | A |
| MOSFET d*v*/d*t* ruggedness | d*v*/d*t* | $V_{DS}$=400V, $I_D$=35A, $T_j$=125°C | 120 | V/ns |
| Reverse diode d*v*/d*t* | | | 70 | |
| Gate source voltage | $V_{GS}$ | Static | ±30 | V |
| | | AC (*f*>1Hz) | | |
| Power dissipation | $P_{tot}$ | $T_c$=25°C | 192.3 | W |

a Preliminary data sheet - Specifications subject to change.
b limited by $Tj_{max}$
c when mounted on 1-inch square 2oz copper-clad FR-4

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| ***Thermal characteristics*** | | | | | | |
| Thermal resistance, junction-case | $R_{thJC}$ | | - | - | 0.65 | °C/W |
| Thermal resistance, junction-ambient [c] | $R_{thJA}$ | Mount on limited PCB layout | - | - | 30 | °C/W |
| Soldering temperature, wave soldering only allowed at leads | $T_{sold}$ | 1.6mm (0.063in.) from case for 10 s | - | - | 260 | °C |

## ***Electrical characteristics*** at $T_j$=25°C, unless otherwise specified

| | | | | | | |
|---|---|---|---|---|---|---|
| ***Static characteristics*** | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0 V, $I_D$=1mA | 600 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=1mA | 3 | 4 | 5 | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=600V, $V_{GS}$=0V | - | - | 10 | μA |
| Gate source leakage current | $I_{GSS}$ | $V_{GS}$=±30 V, $V_{DS}$=0V | - | - | ±100 | nA |
| Drain-source on-state resistance | $r_{DS(on)}$ | $V_{GS}$=10V, $I_D$=15A | - | 56 | 68 | mΩ |
| Gate resistance | $R_G$ | $f$=1 MHz, open drain | - | 1.2 | - | Ω |
| ***Dynamic characteristics*** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0 V, $V_{DS}$=400 V, $f$=1 MHz | - | 3240 | - | pF |
| Reverse transfer capacitance | $C_{rss}$ | | - | 3.5 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 60 | - | pF |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}$=400V, $V_{GS}$=10V, $I_D$=11A, $R_G$=5.3Ω (External) | - | 130 | - | ns |
| Rise time | $t_r$ | | - | 8 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 84 | - | ns |
| Fall time | $t_f$ | | - | 11 | - | ns |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| ***Gate charge characteristics*** | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DS}$=400 V, $I_D$=11A, $V_{GS}$=0 to 10 V | - | 19 | - | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 39 | - | |
| Gate charge total | $Q_g$ | | - | 83 | - | |
| ***Reverse Diode*** | | | | | | |
| Continuous forward current | $I_S$ | $V_{GS}$=0V | - | - | 35 | A |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=15A | - | 0.95 | - | V |
| Reverse recovery time | $t_{rr}$ | $V_{RR}$=400V, $I_S$=11A, $d_{iF}$/dt=100 A/µS | - | 111 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 0.6 | - | µC |
| Peak reverse recovery current | $I_{rm}$ | | - | 9.3 | - | A |

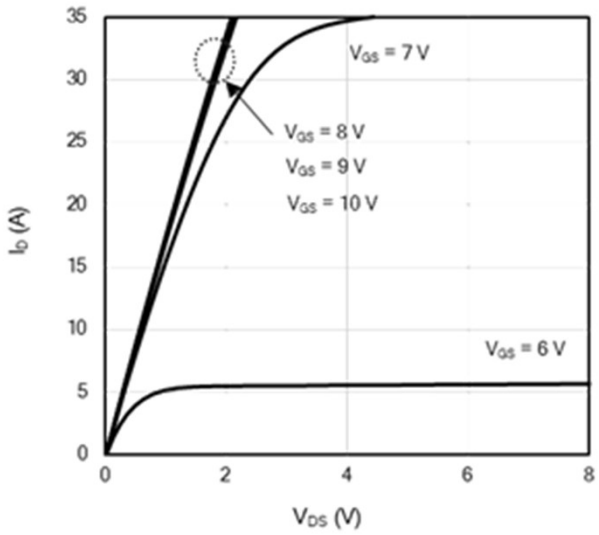



Figure 1: On-Region Characteristics

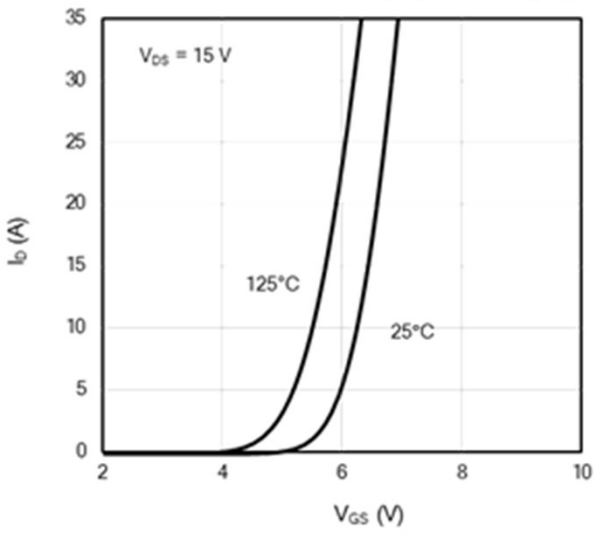



Figure 2: Transfer Characteristics

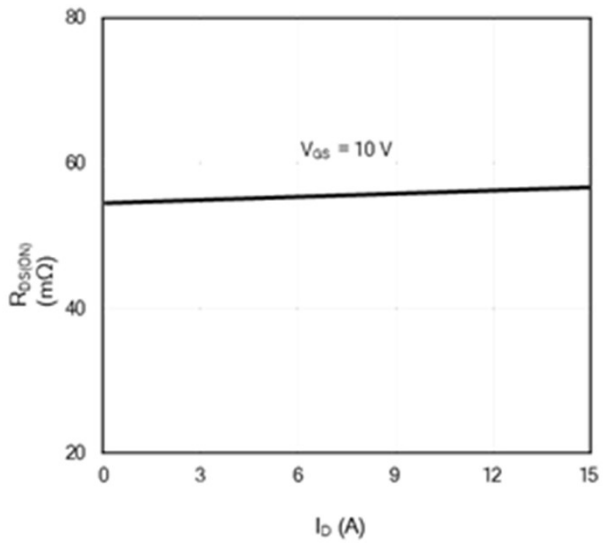



Figure 3: On-Resistance vs. Drain Current and Gate Voltage

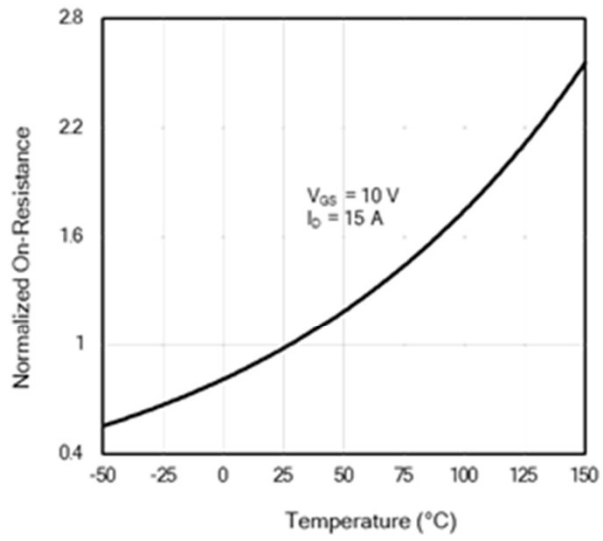



Figure 4: On-Resistance vs. Junction Temperature

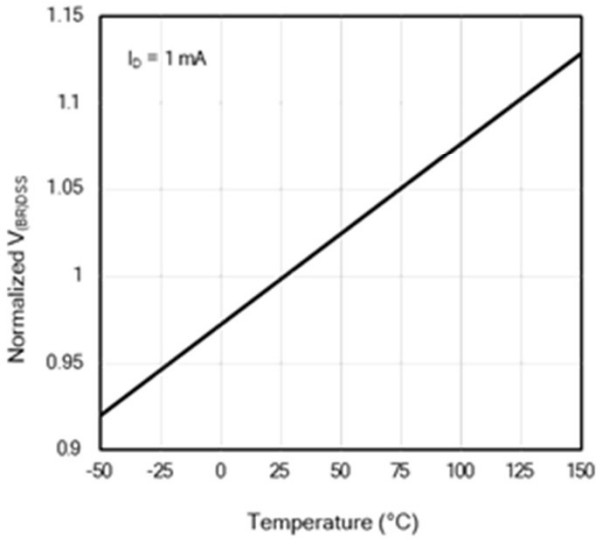



Figure 5: Breakdown Voltage vs. Junction Temperature

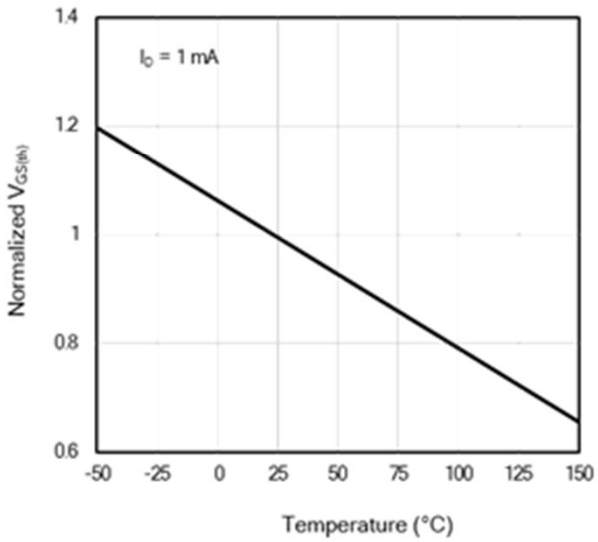



Figure 6: Threshold Voltage vs. Junction Temperature

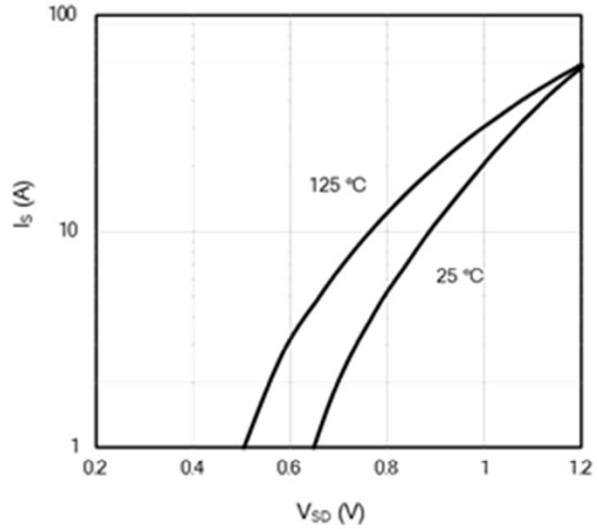



Figure 7: Body-Diode Characteristics

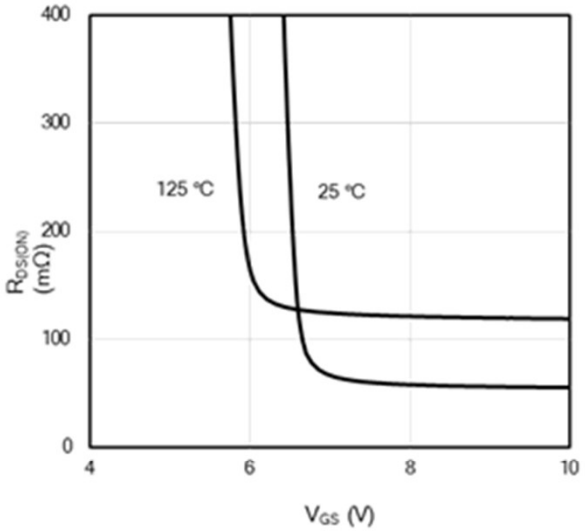



Figure 8: On-Resistance vs. Gate-Source Voltage

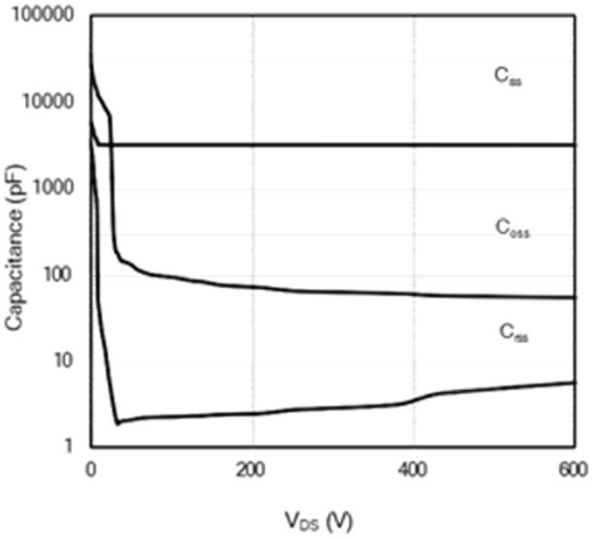



Figure 9: Capacitance Characteristics

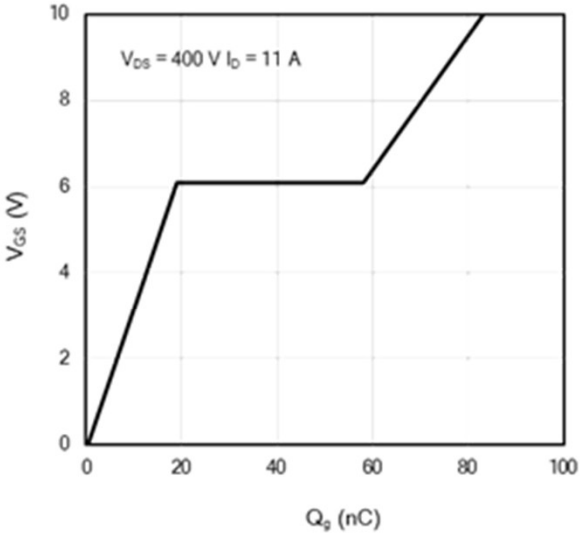



Figure 10: Gate-Charge Characteristics

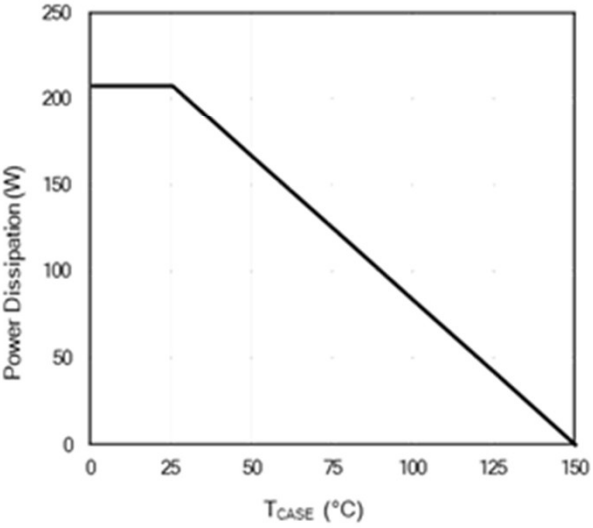



Figure 11: Power De-rating

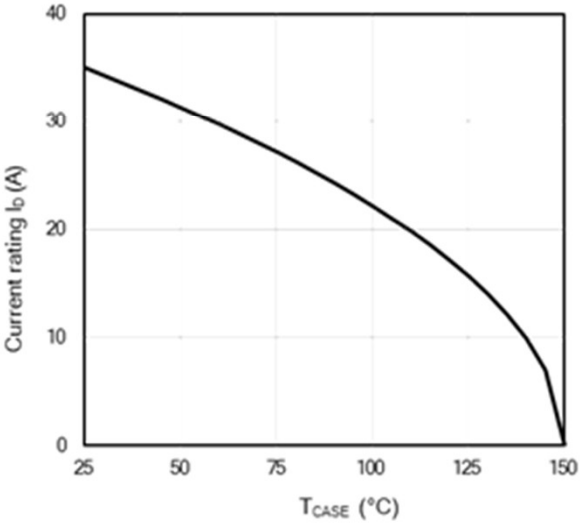



Figure 12: Current De-rating

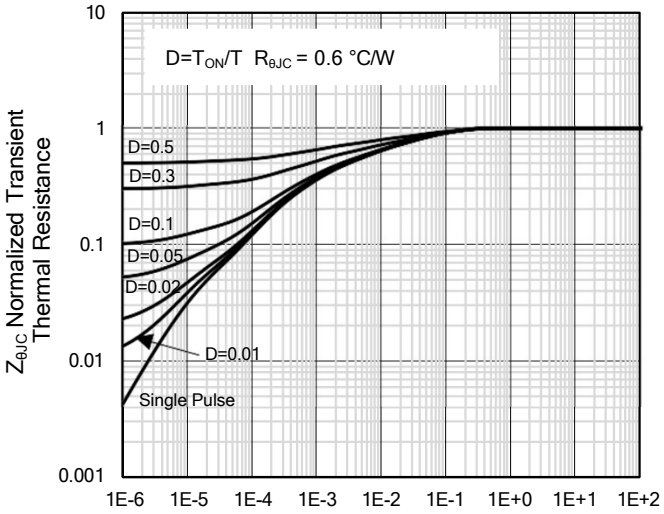



Figure 13: Normalized Maximum Transient Thermal Impedance

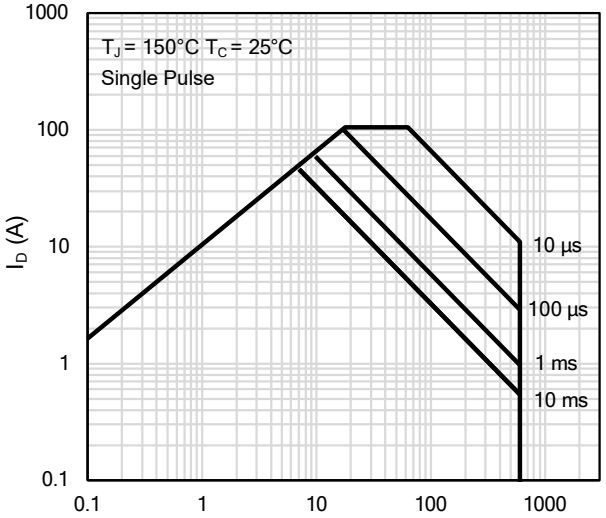



Figure 14: Maximum Forward Biased Safe Operating Area

# Marking Information

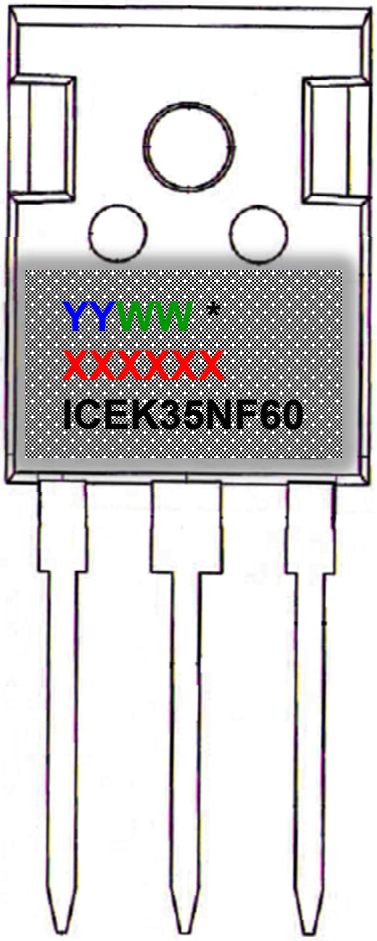
**YY** = Last two digits of the year

**WW** = Work week

* = Site ID

**XXXXXX** = Lot ID

**ICEK35NF60** = ICE is Icemos logo and K35NF60 is a designated device part number




## Disclaimer