IceMOS Technology

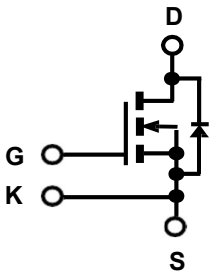
**Preliminary**
**ICE36M120W4**

# ICE36M120W4
# Silicon Carbide Power MOSFET

| Product Summary | | | |
|---|---|---|---|
| $I_D$ | $T_A$=25°C | 47A | Max |
| $V_{(BR)DSS}$ | $T_C$=25°C | 1200V | Min |
| $r_{DS(on)}$ | $V_{GS}$=18V | 36.4mΩ | Typ |
| $Q_g$ | $V_{DS}$=800V | 62nC | Typ |

## Features

- 1200V 36.4mohm SiC MOSFET
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast Reverse Recovery, Low $Q_{rr}$, and Avalanche Ruggedness
- Simple to Drive and Easy to Parallel







**TO247-4L**

**1: D, 2: S, 3: K, 4: G**

RoHS COMPLIANT RoHS (EU) 2015/863

CE

HALOGEN FREE

Lead Free

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

| *Parameter* | *Symbol* | *Conditions* | *Value* | *Unit* |
|---|---|---|---|---|
| Continuous drain current | $I_D$ | $T_c$=25°C | 47 | A |
| | | $T_c$=100°C | 33 | |
| Pulsed drain current | $I_{D,\ pulse}$ | | 177 | A |
| Maximum gate source voltage | $V_{GS(max)}$ | | -10/+22 | V |
| Operational gate source voltage | $V_{GS\ op}$ | | -5/+18 | V |
| Power dissipation | $P_{tot}$ | $T_c$=25°C | 187.5 | W |
| | | $T_c$=100°C | 93.7 | |
| Storage temperature | $T_{stg}$ | | -55 to +175 | °C |
| Operating temperature | $T_j$ | | | |

a Pulse width limited by Tjmax

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |

### Thermal characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Thermal resistance, junction-case | $R_{thJC}$ | | - | - | 0.80 | °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 [a], at $T_j$=25°C, unless otherwise specified

### Static characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V | 1200 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=8.5mA, $T_j$=25°C | 2 | 2.9 | 4 | V |
| | | $V_{DS}$=$V_{GS}$, $I_D$=8.5mA, $T_j$=175°C | - | 2.1 | - | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=1200V, $V_{GS}$=0V, $T_j$=25°C | - | 0.1 | 50 | µA |
| | | $V_{DS}$=1200V, $V_{GS}$=0V, $T_j$=175°C | - | 1 | - | µA |
| Gate source leakage current | $I_{GSS}$ | $V_{GS}$=-10/+22V, $V_{DS}$=0V | - | - | ±100 | nA |
| Drain-source on-state resistance | $R_{DS\ (on)}$ | $V_{GS}$=18V, $I_D$=30A, $T_j$=25°C | - | 36.4 | 47 | mΩ |
| | | $V_{GS}$=18V, $I_D$=30A, $T_j$=175°C | - | 66 | - | mΩ |
| Gate resistance | $R_G$ | $f$=1 MHz, $V_{AC}$=30mV | - | 2.5 | - | Ω |

### Dynamic characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Input capacitance | $C_{iss}$ | $V_{DS}$=800V, $V_{GS}$=0V, $f$=100 kHz, $V_{AC}$=30mV | - | 1855 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 79 | - | pF |
| Reverse transfer capacitance | $C_{rss}$ | | - | 3.5 | - | pF |
| $C_{OSS}$ stored energy | $E_{oss}$ | | - | 31 | - | µJ |
| Forward transconductance | $g_{FS}$ | $V_{DS}$=20V, $I_D$=30A | - | 20 | - | S |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}$=800V, $V_{GS}$=-5/+18V, $I_D$=30A, $R_G$=7.5Ω (External), $T_j$=25°C | - | 10 | - | ns |
| Rise time | $t_r$ | | - | 14 | - | ns |
| Turn-off delay time | $t_{d(off)}$ | | - | 21 | - | ns |
| Fall time | $t_f$ | | - | 10 | - | ns |
| Turn-on switching energy | $E_{ON}$ | | - | 249 | - | µJ |
| Turn-off switching energy | $E_{OFF}$ | | - | 39 | - | µJ |

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| ***Dynamic characteristics*** | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}$=800V, $V_{GS}$=-5/+18V, $I_D$=30A, $R_G$=7.5Ω (External), $T_j$=175°C | - | 9 | - | ns |
| Rise time | $t_r$ | | - | 17 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 27 | - | |
| Fall time | $t_f$ | | - | 10 | - | |
| Turn-on switching energy | $E_{ON}$ | | - | 342 | - | µJ |
| Turn-off switching energy | $E_{OFF}$ | | - | 40 | - | |
| ***Gate Charge Characteristics*** | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DS}$=800V, $I_D$=30A, $V_{GS}$=-5 to +18V | - | 23 | - | nC |
| Gate to drain charge | $Q_{gd}$ | | - | 7.2 | - | |
| Gate charge total | $Q_g$ | | - | 62 | - | |
| ***Reverse Diode*** | | | | | | |
| Continuous forward current | $I_S$ | $V_{GS}$=-5V | - | - | 47 | A |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=-5V, $I_{SD}$=15A, $T_j$=25°C | - | 3.9 | - | V |
| | | $V_{GS}$=-5V, $I_{SD}$=15A, $T_j$=175°C | - | 3.8 | - | |
| Reverse recovery time | $t_{rr}$ | $V_{GS}$=-5V, $V_{RR}$=800V, $I_{SD}$=30A, $d_{iF}/d_t$=7.84 kA/µs, $T_j$=25°C | - | 9 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 184 | - | nC |
| Peak reverse recovery current | $I_{rm}$ | | - | 33 | - | A |
| Reverse recovery time | $t_{rr}$ | $V_{GS}$=-5V, $V_{RR}$=800V, $I_{SD}$=30A, $d_{iF}/d_t$=9.21 kA/µs, $T_j$=175°C | - | 15 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 653 | - | nC |
| Peak reverse recovery current | $I_{rm}$ | | - | 69 | - | A |

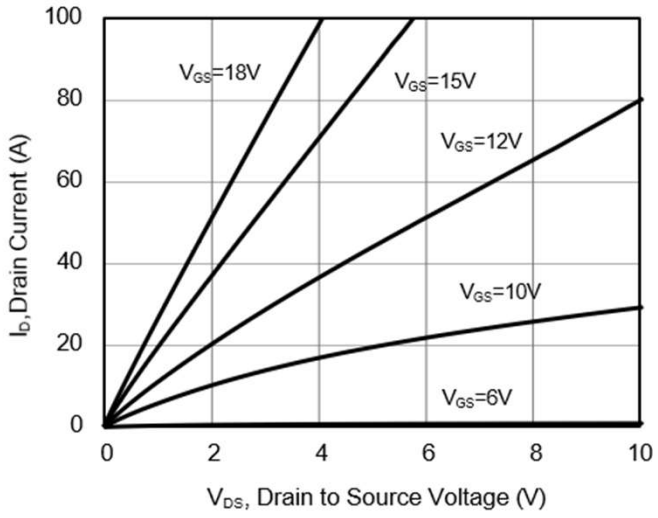



Fig 1. Output Characteristics, $T_j$=-55°C

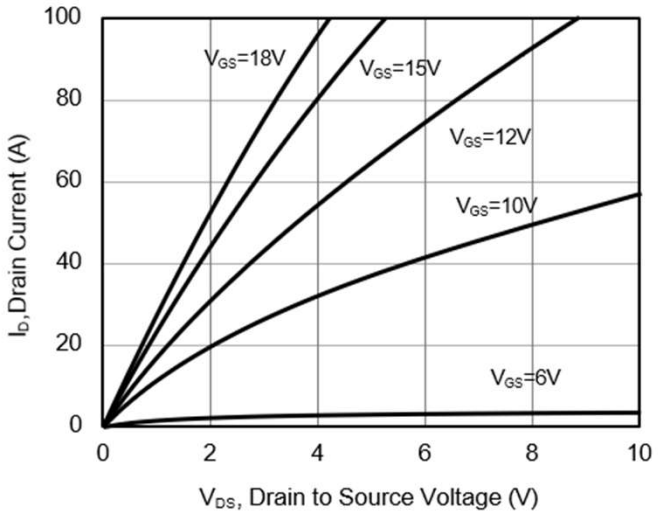



Fig 2. Output Characteristics, $T_j$=25°C

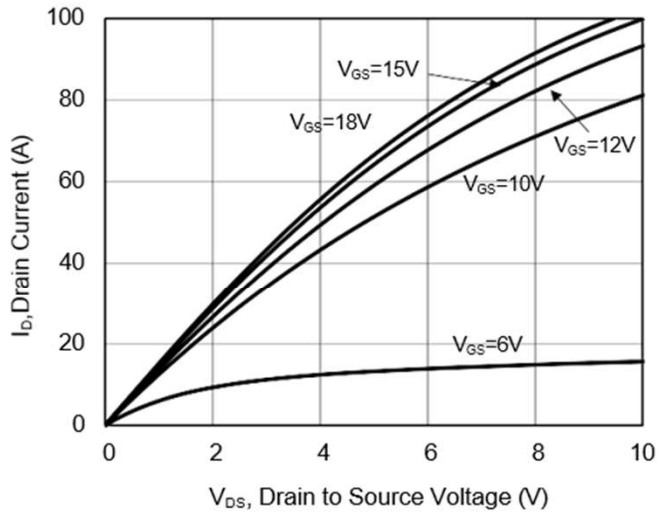



Fig 3. Output Characteristics, $T_j$=175°C

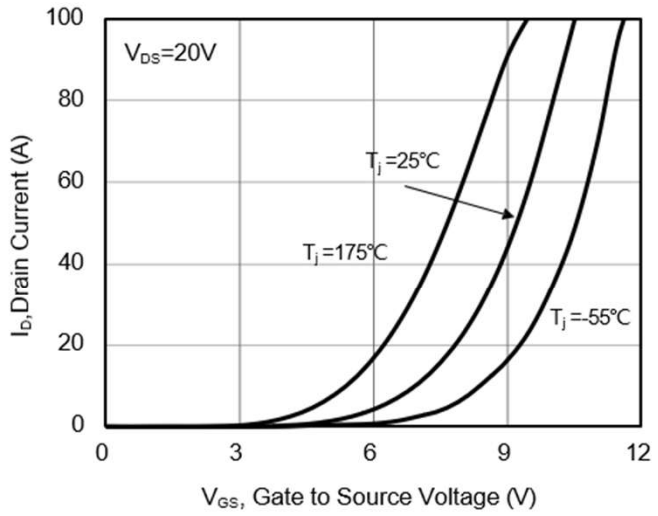



Fig 4. Transfer Characteristics

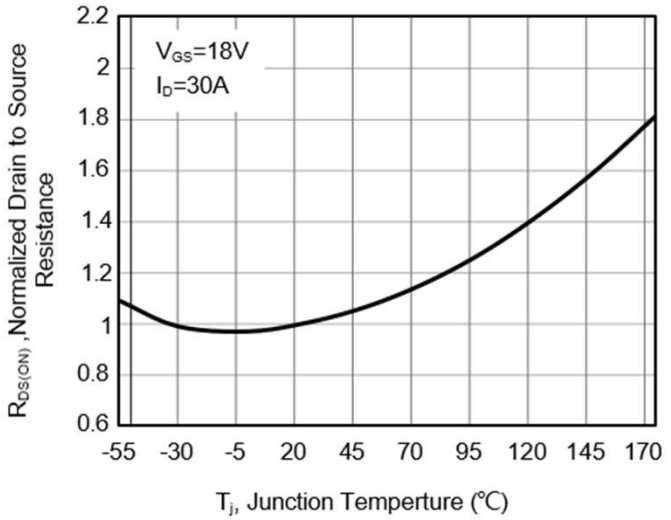



Fig 5. On−Resistance Variation with Temperature

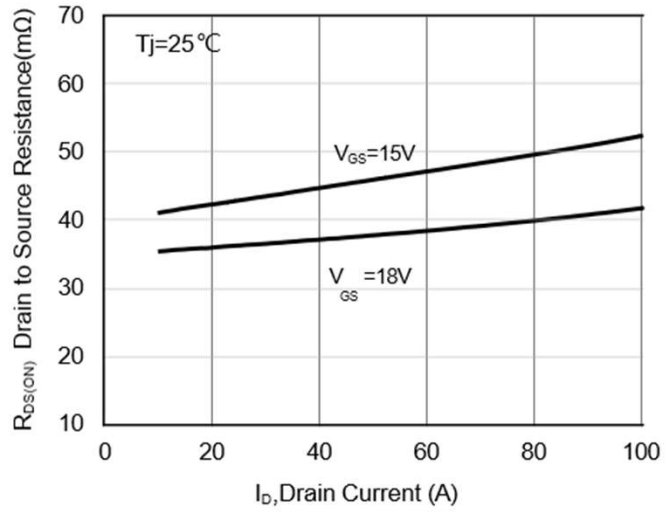



Fig 6. On-Resistance vs Drain Current

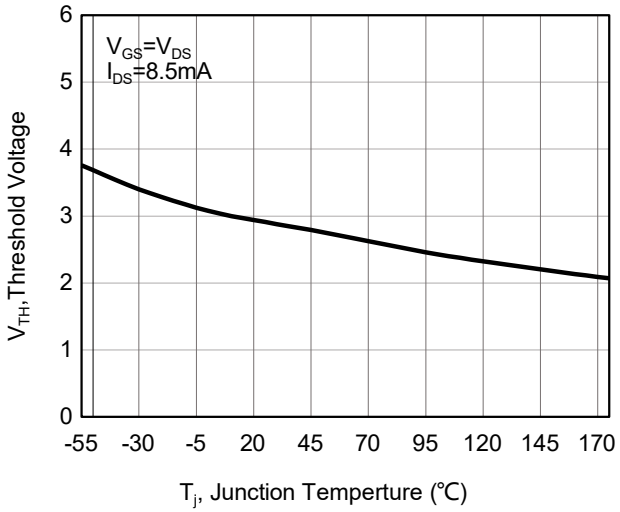



Fig 7. Gate Threshold vs Temperature

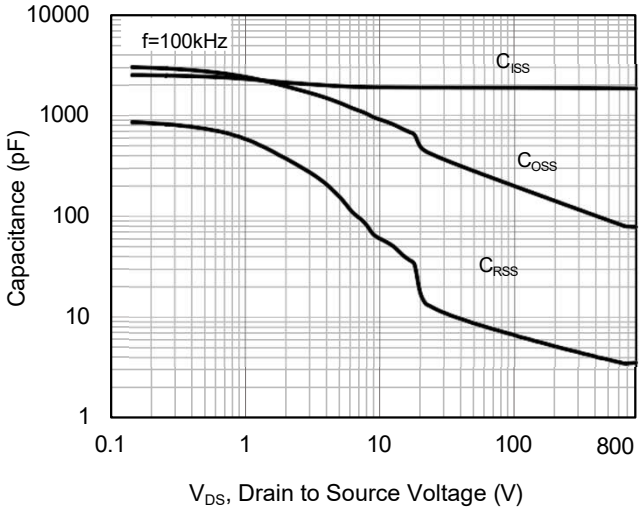



Fig 8. Capacitance Characteristics

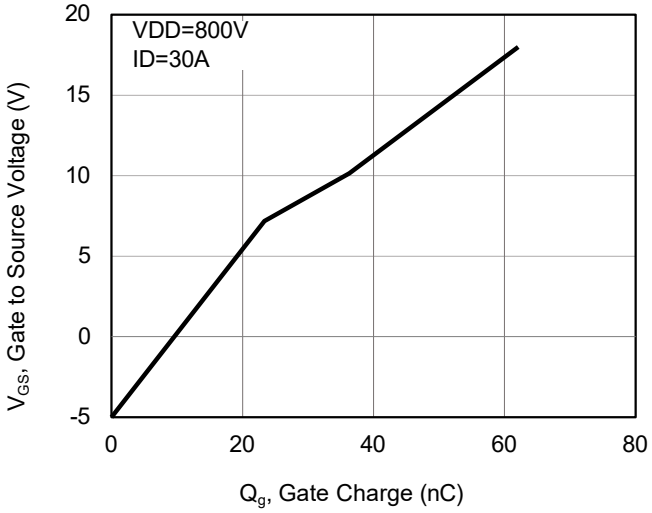



Fig 9. Continuous Drain Current Derating Vs. Case Temperature

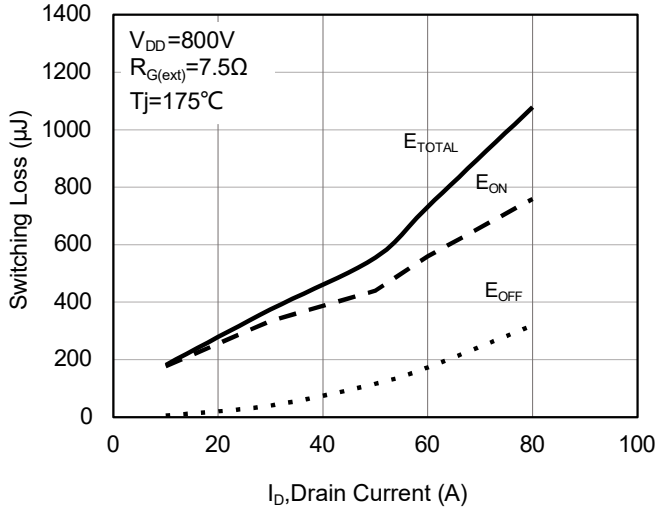



Fig 10. Switching Energy vs. Drain Current

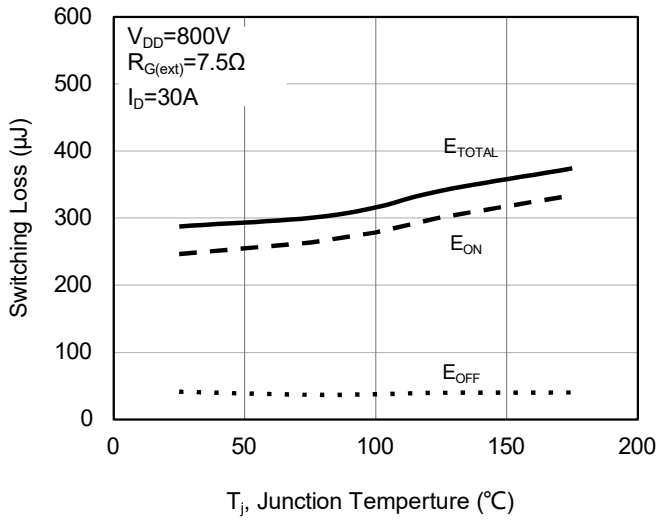



Fig 11. Switching Energy vs. Temperature

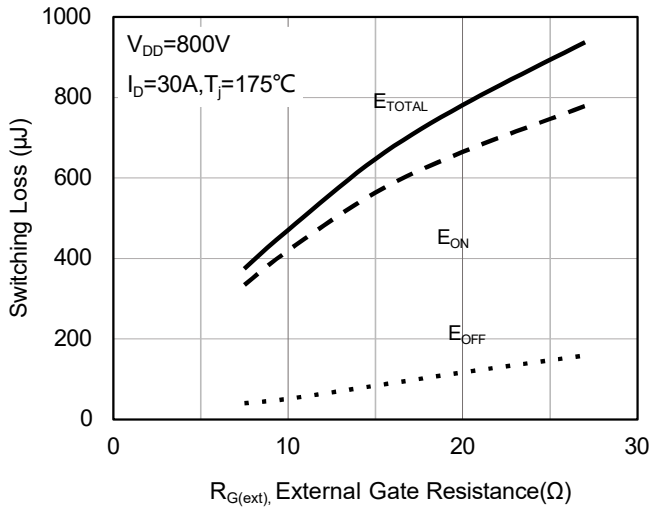



Fig 12. Switching Energy vs. Gate Resistance

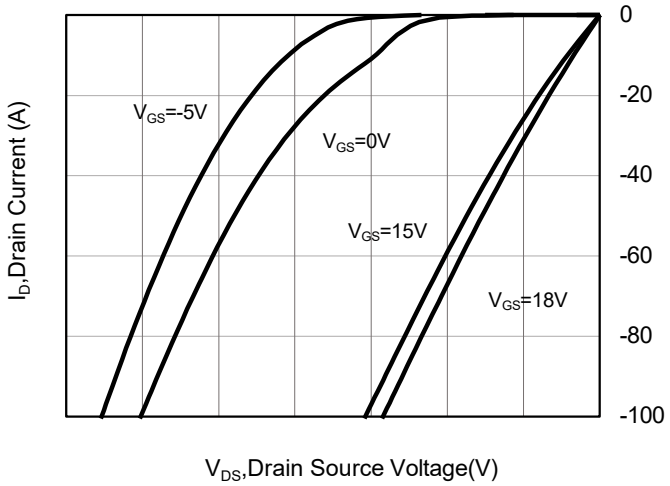



Fig 13. 3rd Quadrant Characteristic at -55 ºC

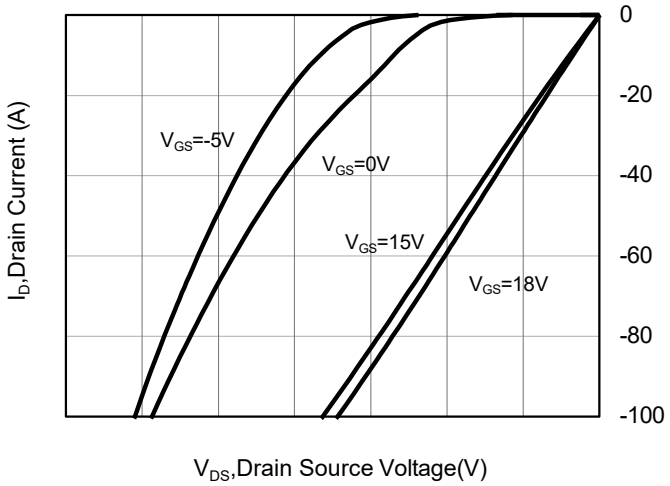



Fig 14. 3rd Quadrant Characteristic at 25 ºC

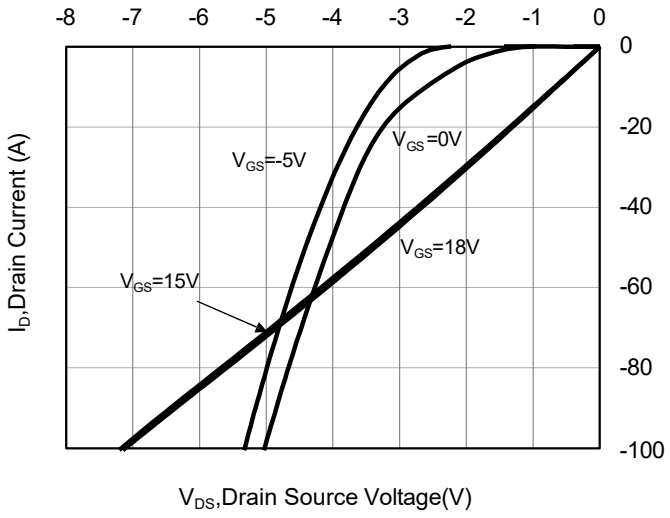
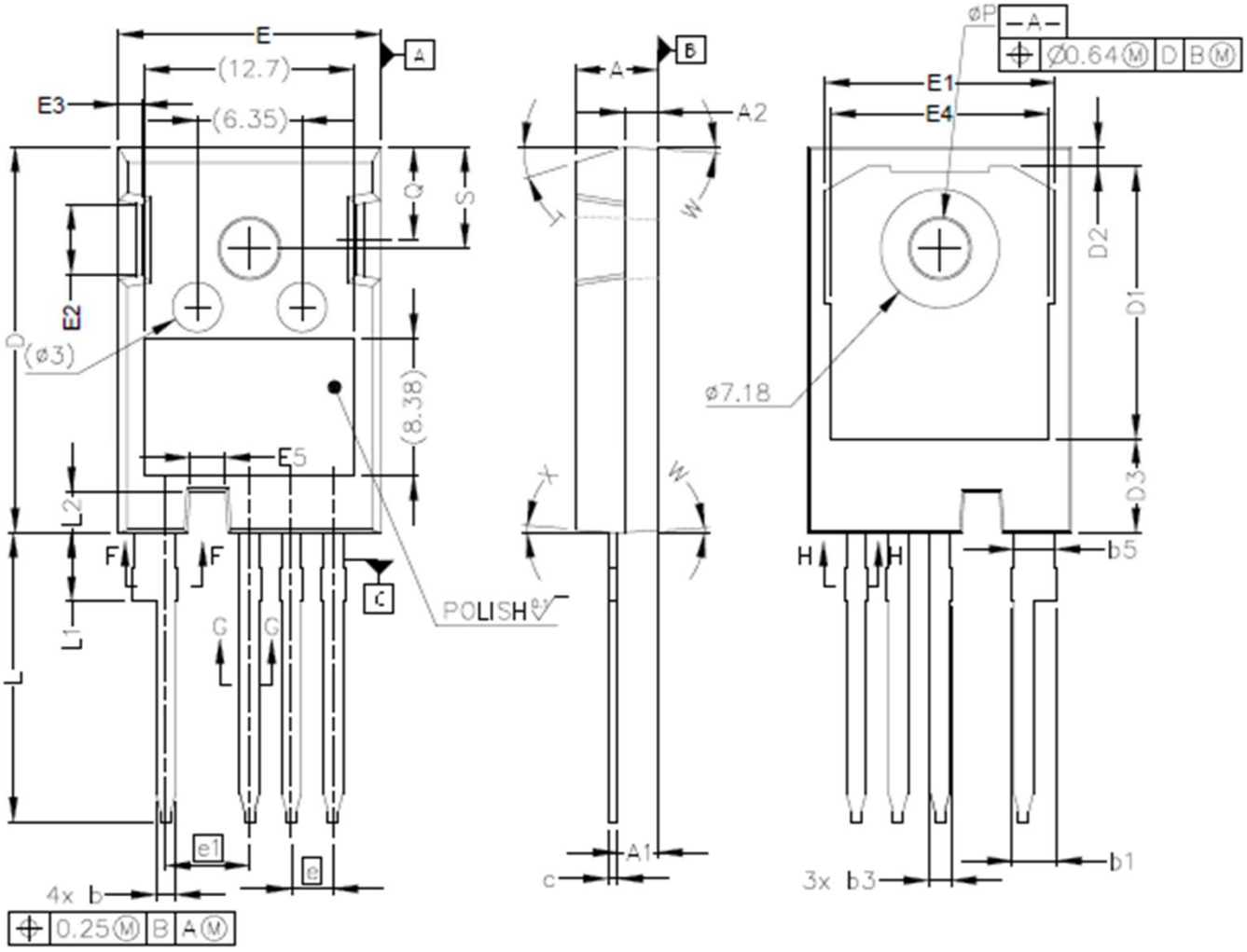
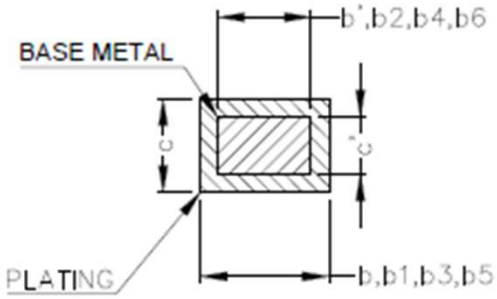



Fig 15. 3rd Quadrant Characteristic at 175 ºC

# Package Outline: TO-247-4L




SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

# Package Outline: TO-247-4L

NOTE ;
1. ALL METAL SURFACES: TIN PLATED,EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.

| SYMBOL | MILLIMETERS | |
|---|---|---|
| | MIN | MAX |
| A | 4.83 | 5.21 |
| A1 | 2.29 | 2.54 |
| A2 | 1.91 | 2.16 |
| b' | 1.07 | 1.28 |
| b | 1.07 | 1.33 |
| b1 | 2.39 | 2.94 |
| b2 | 2.39 | 2.84 |
| b3 | 1.07 | 1.60 |
| b4 | 1.07 | 1.50 |
| b5 | 2.39 | 2.69 |
| b6 | 2.39 | 2.64 |
| c' | 0.55 | 0.65 |
| c | 0.55 | 0.68 |
| D | 23.30 | 23.60 |
| D1 | 16.25 | 17.65 |
| D2 | 0.95 | 1.25 |
| D3 | 5.55 | 6.15 |
| E | 15.75 | 16.13 |
| E1 | 13.10 | 14.15 |
| E2 | 3.68 | 5.10 |
| E3 | 1.00 | 1.90 |
| E4 | 12.38 | 13.43 |
| E5 | 1.95 | 2.35 |
| e | 2.54 BSC | |
| e1 | 5.08 BSC | |
| N | 4 | |
| L | 17.31 | 17.82 |
| L1 | 3.97 | 4.37 |
| L2 | 2.35 | 2.65 |
| øP | 3.51 | 3.65 |
| Q | 5.49 | 6.00 |
| S | 6.04 | 6.30 |
| T | 17.5° REF. | |
| W | 3.5 ° REF. | |
| X | 4° REF. | |

# Marking Information

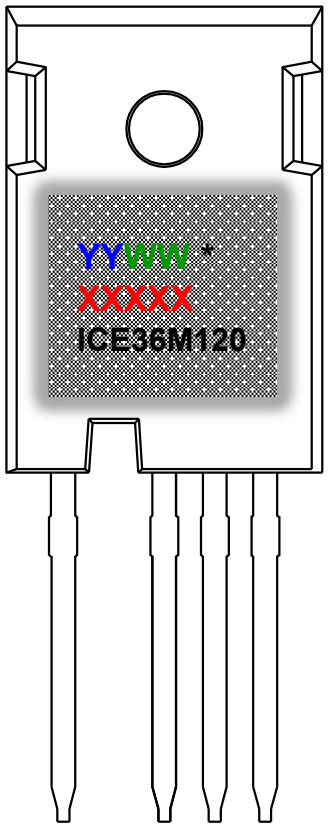
**YY** = Last two digits of the year

**WW** = Work week

* = Site ID

**XXXXX** = Lot ID

**ICE36M120** = ICE is IceMOS logo and 36M120 is a designated device part number




## Disclaimer

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