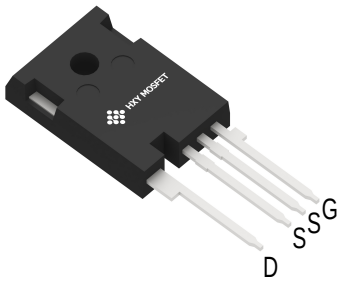
# NTH4L013N120M3S

SiC Power MOSFET N-Channel Enhancement Mode

## Features

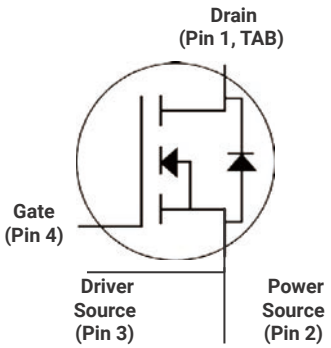
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Easy to Parallel and Simple to Drive
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant




TO-247H-4L

## Applications

- Solar Inverters
- Switch Mode Power Supplies
- High voltage DC/DC converters
- EV Motor drive




| Ordering Part Number | Package | Qty(PCS) |
|---|---|---|
| NTH4L013N120M3S | TO-247H-4L | 30 |

## Maximum Ratings ($T_C$ = 25 °C unless otherwise specifed)

| Parameter | Symbol | Condition | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{DSmax}$ | $V_{GS}$=0V, $I_D$=100uA | 1200 | V |
| Gate-Source Voltage | $V_{GSmax}$ | Absolute maximum values | -10/+22 | V |
| Gate-Source Voltage | $V_{GSop}$ | Recommended operational values | -5/+18 | V |
| Continuous Drain Current | $I_D$ | $V_{GS}$=18V, $T_C$=25℃ | 167 | A |
| | | $V_{GS}$=18V, $T_C$=100℃ | 118 | |
| Pulsed Drain Current | $I_{D(pulse)}$ | Pulse width $t_p$ limited by $T_{jmax}$ | TBD | A |
| Power Dissipation | $P_D$ | $T_C$=25℃, $T_J$=175℃ | 555 | W |
| Operating Junction Temperature | $T_{vj, op}$ | | -55~175 | ℃ |
| Storage Temperature Range | $T_{stg}$ | | -55~175 | ℃ |

## Electrical Characteristic (at Tj = 25 °C, unless otherwise specified)

| Parameter | Symbol | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ. | Max | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$=100μA | | 1200 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=20mA | $T_{vj}$=25℃ | | 2.9 | | V |
| | | | $T_{vj}$=175℃ | | 2.1 | | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=1200V, $V_{GS}$=0V | | | 1 | 100 | μA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=18V, $V_{DS}$=0V | | | 1 | 100 | nA |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}$=18V, $I_D$=75A | $T_{vj}$=25℃ | | 13 | | mΩ |
| | | | $T_{vj}$=175℃ | | 20 | | |
| Transconductance | $g_{fs}$ | $V_{DS}$=20V, $I_{DS}$=75A | $T_{vj}$=25℃ | | TBD | | S |
| | | | $T_{vj}$=175℃ | | TBD | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$=0V<br>$V_{DS}$=1200V<br>f=100KHz<br>$V_{AC}$=25mV | | | 3815 | | pF |
| Output Capacitance | $C_{oss}$ | | | | 239 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | | 29 | | |
| $C_{oss}$ Stored Energy | $E_{oss}$ | | | | TBD | | μJ |
| Turn-On Switching Energy | $E_{ON}$ | $V_{DS}$=800V, $V_{GS}$=-5/18V<br>$I_D$=75A, $R_{G(ext)}$=2.5Ω,<br>L=250μH | $T_{vj}$=25℃ | | TBD | | μJ |
| | | | $T_{vj}$=175℃ | | TBD | | |
| Turn Off Switching Energy | $E_{OFF}$ | | $T_{vj}$=25℃ | | TBD | | |
| | | | $T_{vj}$=175℃ | | TBD | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DS}$=800V, $V_{GS}$=-5/18V<br>$I_D$=75A, $R_{G(ext)}$=2.5Ω,<br>$T_J$=25℃, L=250μH<br>Timing relative to $V_{DS}$ | | | TBD | | ns |
| Rise Time | $t_r$ | | | | TBD | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | | TBD | | |
| Fall Time | $t_f$ | | | | TBD | | |
| Internal Gate Resistance | $R_{G(int)}$ | f=1MHz, $V_{AC}$=25mV | | | TBD | | Ω |
| Gate to Source Charge | $Q_{gs}$ | $V_{DS}$=800V, $V_{GS}$=-5/18V<br>$I_D$=75A | | | 46 | | nC |
| Gate to Drain Charge | $Q_{gd}$ | | | | 100 | | |
| Total Gate Charge | $Q_g$ | | | | 216 | | |

## Body Diode Characteristic

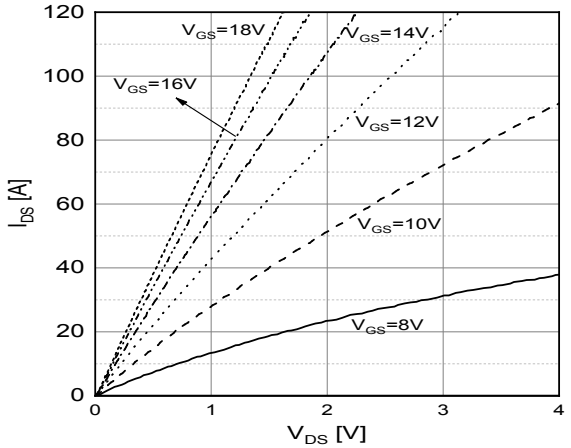
| Parameter | Symbol | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ. | Max | |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=-5V, $I_{SD}$=37.5A | $T_{vj}$=25℃ | | 4.7 | | V |
| | | | $T_{vj}$=175℃ | | 4.1 | | |
| Continuous Diode Forward Current | $I_S$ | $V_{GS}$=-5V, $T_C$=25˚C | | | | TBD | A |
| Diode Pulse Current | $I_{S(pulse)}$ | $V_{GS}$=-5V, Pulse width $t_p$ limited by $T_{jmax}$ | | | | TBD | A |
| Reverse Recovery Time | $t_{rr}$ | $V_{GS}$=-5V<br>$I_{SD}$=37.5A<br>$R_{G(ext)}$=2.5Ω<br>$T_J$=175℃<br>$V_R$=800V | | | TBD | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | | TBD | | nC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | | | TBD | | A |

## Thermal Characteristics

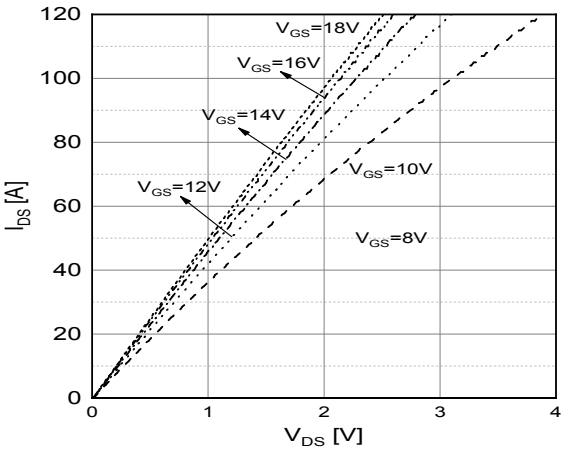
| Parameter | Symbol | Condition | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ. | Max | |
| Thermal Resistance: Junction to Case | $R_{th(J-C)}$ | | | 0.27 | 0.37 | ℃/W |

## Typical Performance

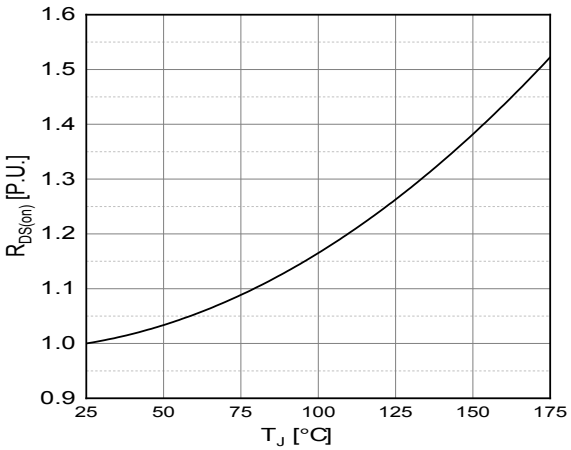
**Output Characteristics**
**$I_{DS}=f(V_{DS})$, $T_J=25°C$**



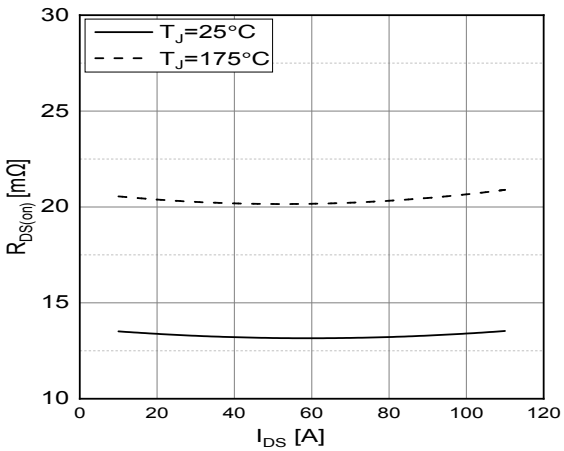

**Output Characteristics**
**$I_{DS}=f(V_{DS})$, $T_J=175°C$**



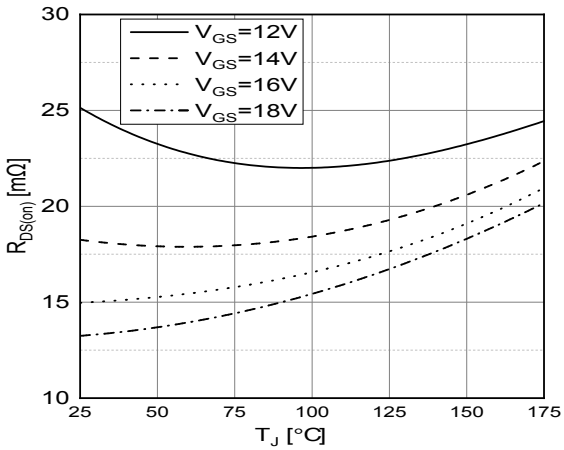

**Normalized On-Resistance**
**$R_{DS(on)}=f(T_J)$, $I_{DS}$=75A, $V_{GS}$=18V**



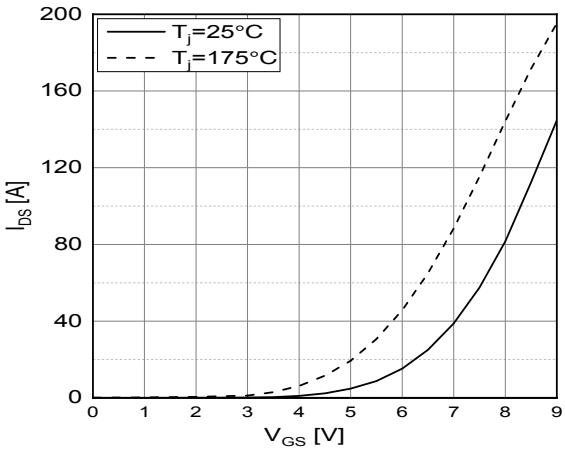

**On-Resistance**
**$R_{DS(on)}=f(I_{DS})$, $V_{GS}$=18V**



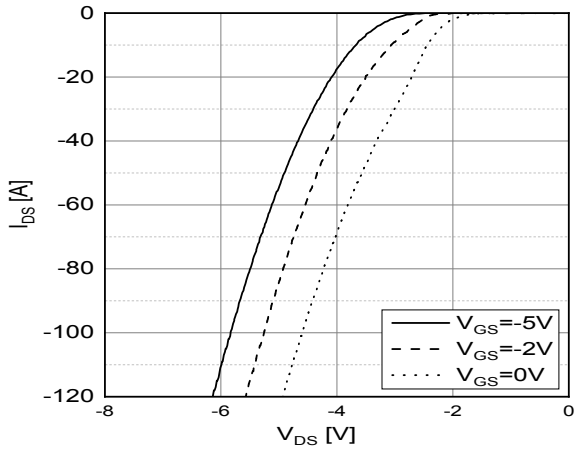

**On-Resistance**
**$R_{DS(on)}=f(T_J)$, $I_{DS}$=75A**



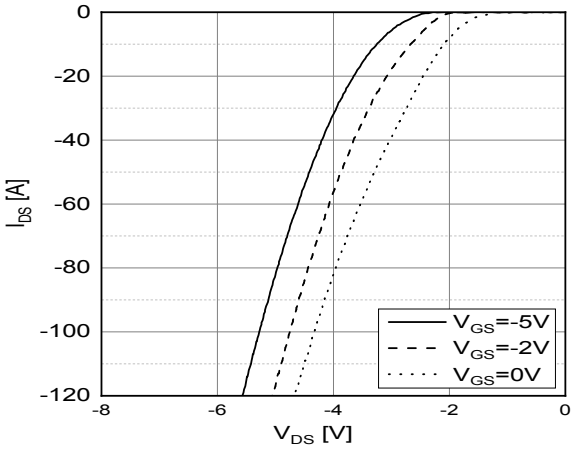

**Transfer Characteristics**
**$I_{DS}=f(V_{GS})$, $V_{DS}$=20V**



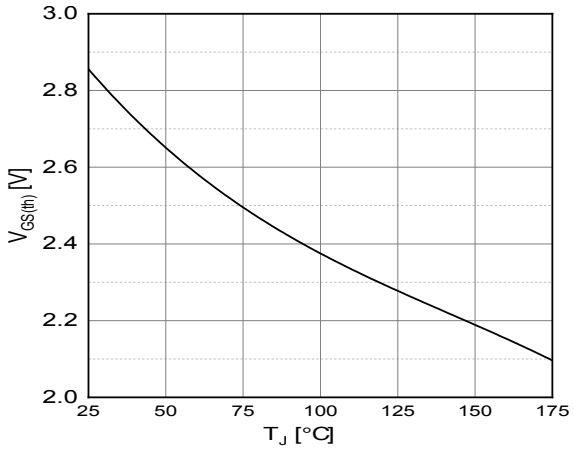
**Body Diode Characteristics**
**$I_{DS}=f(V_{DS})$, $T_J=25$°C**



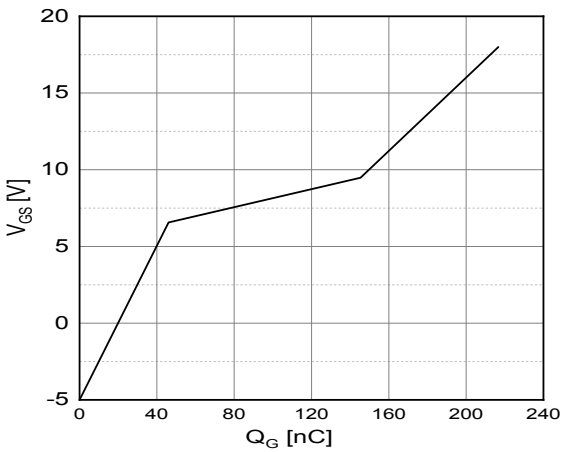

**Body Diode Characteristics**
**$I_{DS}=f(V_{DS})$, $T_J=175$°C**



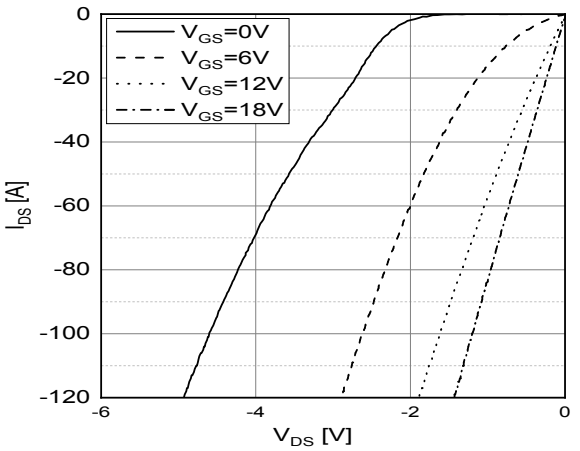

**Threshold Voltage**
**$V_{GS(th)}=f(T_J)$, $V_{GS}=V_{DS}$, $I_{DS}=20$mA**



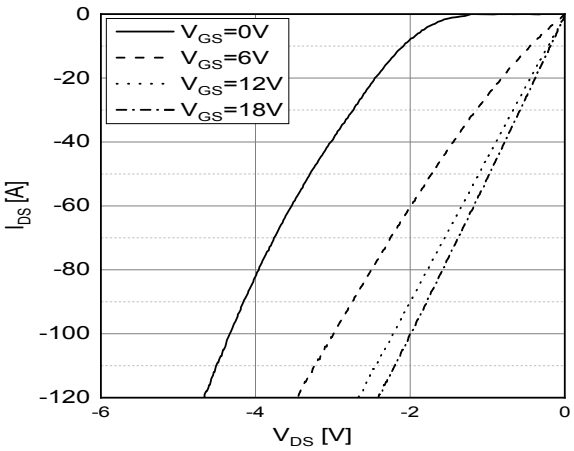

**Gate Charge Characteristics**
**$V_{GS}=f(Q_G)$, $I_{DS}=75$A, $I_{GS}=50$mA, $V_{DS}=800$V, $T_J=25$°C**



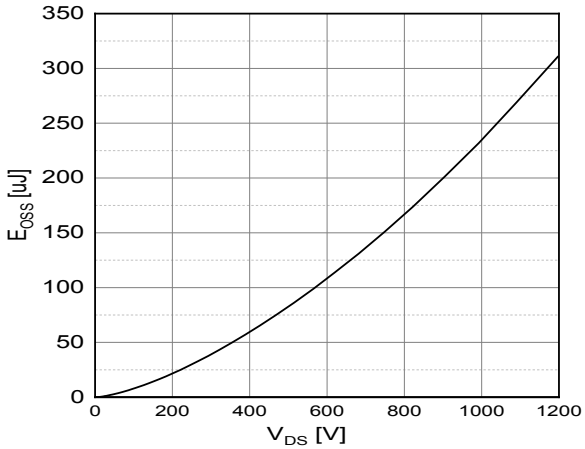

**3rd Quadrant Characteristics**
**$I_{DS}=f(V_{DS})$, $T_J=25$°C**



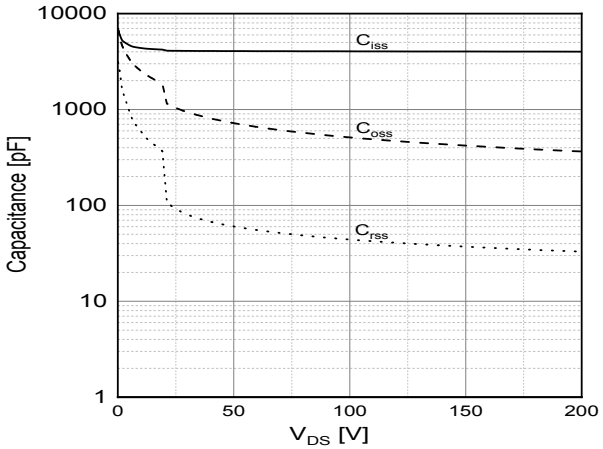

**3rd Quadrant Characteristics**
**$I_{DS}=f(V_{DS})$, $T_J=175$°C**



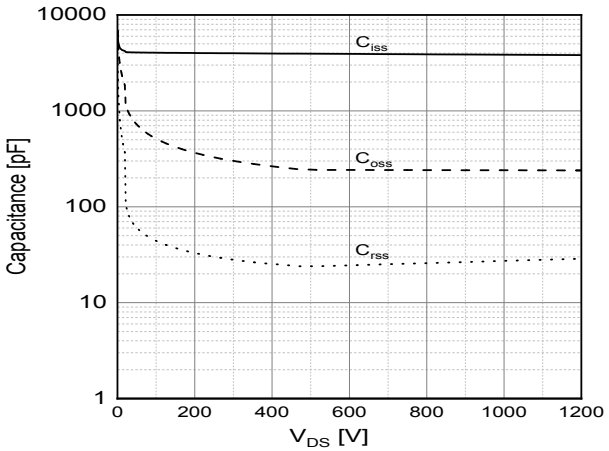
**Output Capacitor Stored Energy**
**$E_{OSS}=f(V_{DS})$**



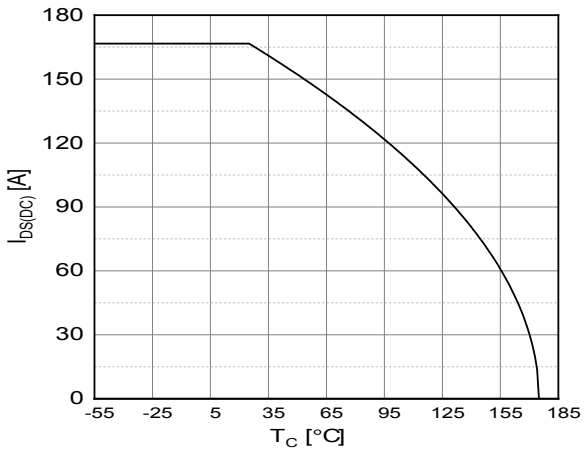

**Capacitances**
**Capacitances=f($V_{DS}$), $T_J$=25°C, $V_{AC}$=25mV, f=100KHz, (0-200V)**



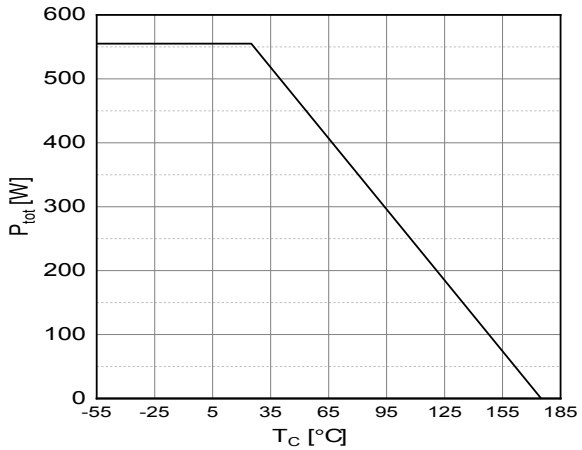

**Capacitances**
**Capacitances=f($V_{DS}$), $T_J$=25°C, $V_{AC}$=25mV, f=100KHz, (0-1200V)**



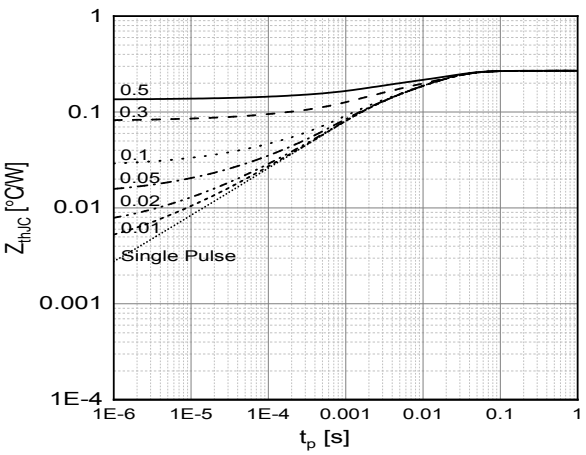

**Continuous Drain Current Derating**
**$I_{DS(DC)}=f(T_C)$, $T_J \leq 175$°C**



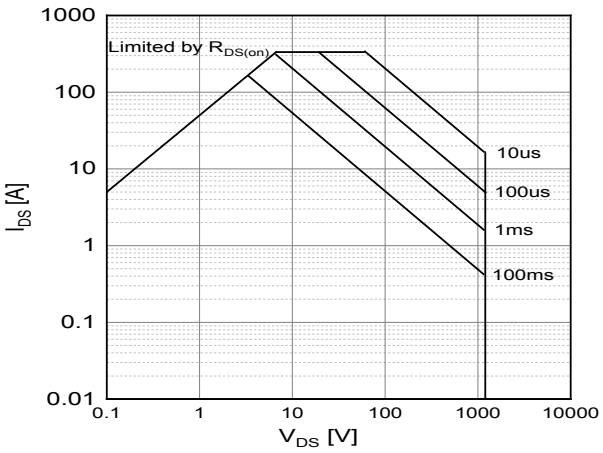

**Maximum Power Dissipation Derating**
**$P_{tot}=f(T_C)$, $T_J \leq 175$**°C



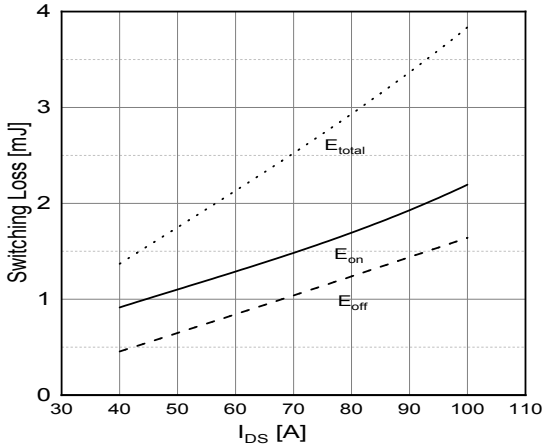

**Transient Thermal Impedance (Junction-Case)**
**$Z_{thJC}=f(t_p)$**



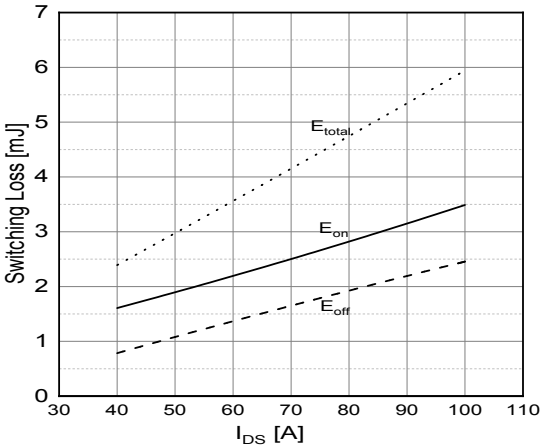
**Safe Operating Area**
**$I_{DS}=f(V_{DS})$, $T_C=25°C$, D=0, Parameter: $t_p$**



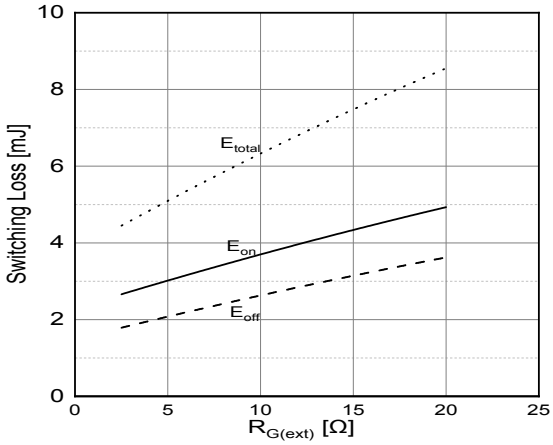

**Switching Energy**
**Switching Loss=f($I_{DS}$), $T_J=25°C$, $V_{DD}=600V$, $R_{G(ext)}=2.5Ω$, $V_{GS}=-5V/+18V$, L=150uH**



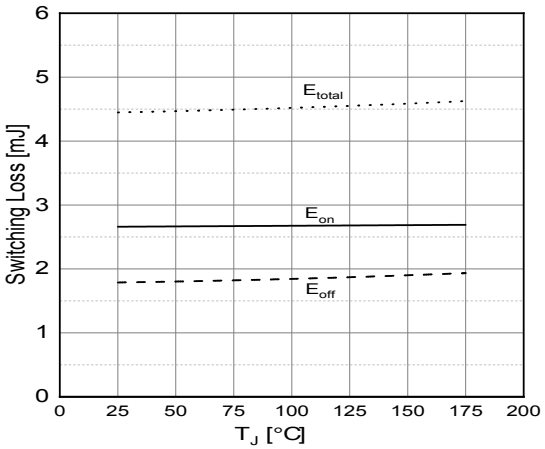

**Switching Energy**
**Switching Loss=f($I_{DS}$), $T_J=25°C$, $V_{DD}=800V$, $R_{G(ext)}=2.5Ω$, $V_{GS}=-5V/+18V$, L=150uH**



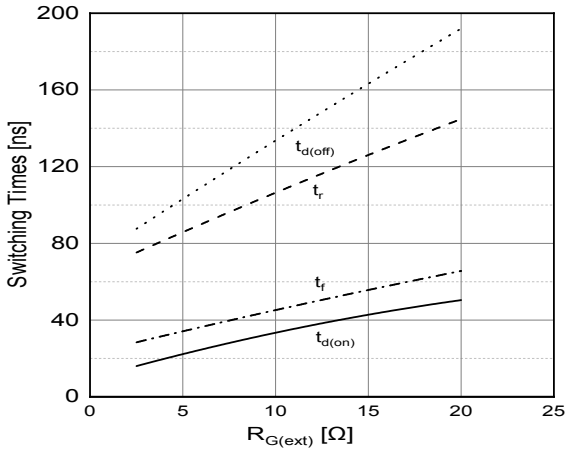

**Switching Energy**
**Switching Loss=f($R_{G(ext)}$), $T_J=25°C$, $V_{DD}=800V$, $I_{DS}=75A$, $V_{GS}=-5V/+18V$, L=150uH**




**Switching Energy**
**Switching Loss=f($T_J$), $V_{DD}=800V$, $I_{DS}=75A$, $R_{G(ext)}=2.5Ω$, $V_{GS}=-5V/+18V$, L=150uH**

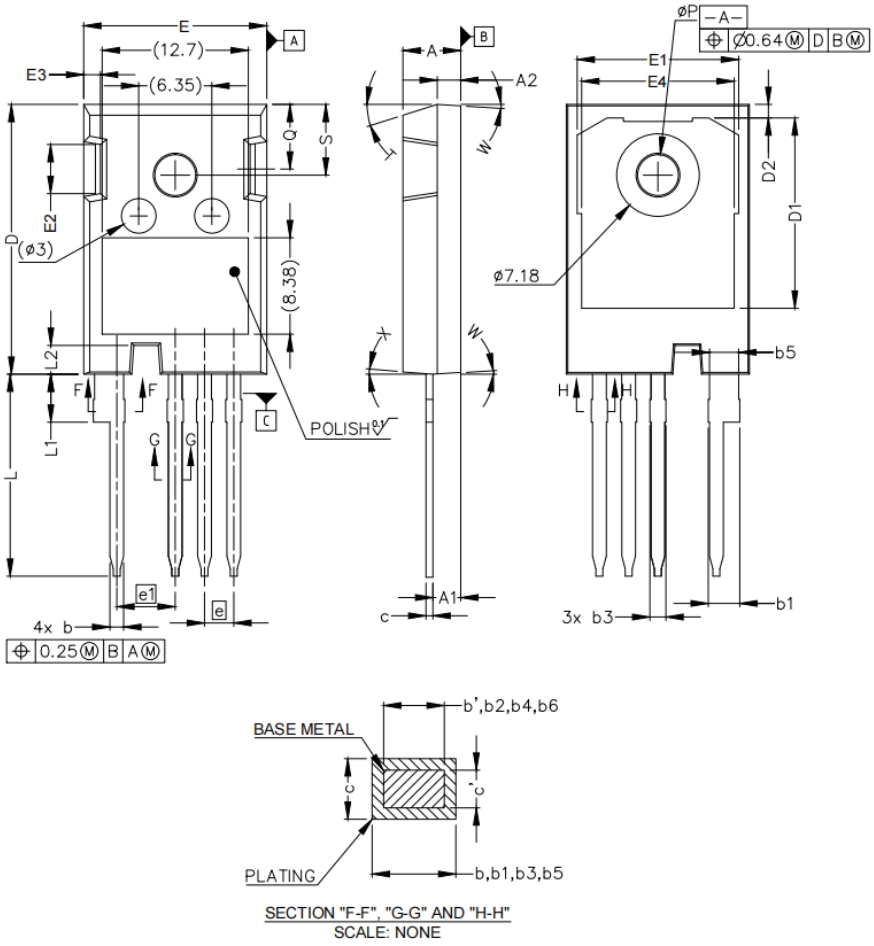



**Switching Times**
**Switching Times=f($R_{G(ext)}$), $T_J=25°C$, $V_{DD}=800V$, $I_{DS}=75A$, $V_{GS}=-5V/+18V$, L=150uH**



## Package Dimensions

Package TO-247H-4L







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

| 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 |
| 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 |
| 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. | |

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Global Electronic Components Distributor

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## HXY MOSFET:

HSEN2411D3 RLSD32A121V AZ4836-01L HSEN3611D3 PESDNC2XD5VBL TPSMB28A-VR
PJEC5V0M1FN2 ESD5L5.0C-HXY HSG3D15B3.3MA TPSMB100CA-VR HCEZ36V,L3F HSTS521050B331
LM393DR-HXY HESDSLC3V3D3B HPTVSUC3D5VB PESDLC2FD3V3BH PESDNC2XD5VBF
PJSD24CW_R1 60N06 AQ15C-01FTG AZ4007-01H HAZ4007-01H HESD36VD3B ESD5LM5.0C-HXY
HLY323BC1524L HSD15C.TCT PESDSC2FD5VU BV05C-H HACPDQC5V0-HF HRCLAMP3371ZCTFT