

# NCH75R190S

## N-Channel Silicon Carbide MOSFET



**Voltage:** 750 Volts

**Current:** 15.5 Ampers

**Package:** TO-252

### Features

- NH'S Advanced Silicon Carbide MOSFET Technology
- High Blocking Voltage And Low Capacitances
- High-Speed Switching For Very Low Switching Losses
- Excellent  $Q_g \cdot R_{ds(on)}$  Product(FOM)

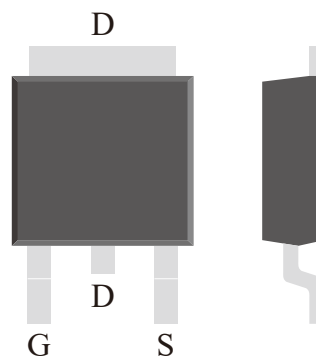
### Typical Applications

- High Voltage DC/DC Converters
- Adaptor And Charger
- Battery Chargers And Motor Drives
- LED Drives And LED Lighting

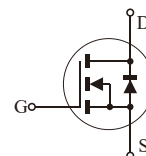
### Product Summary

|                          |      |    |
|--------------------------|------|----|
| VDS Min.@Tj              | 750  | V  |
| Id Min.@Ta               | 15.5 | A  |
| RDS(ON)(TYP)@18V,Tj=25°C | 190  | mΩ |

### Diagram:



### Polarity:



**\*100% UIS TESTED**

**\*100% ΔVDS TESTED**

### Absolute Maximum Ratings (Ta=25°C Unless Otherwise Specified)

| Parameter                                                                    | Test Conditions                                                      | Symbol                           | Ratings                | Unit |
|------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------|------------------------|------|
| Drain-Source Voltage                                                         |                                                                      | $V_{DS}$                         | 750                    | V    |
| Gate-Source Voltage                                                          |                                                                      | $V_{GS\ MAX.}$<br>$V_{GS\ O.P.}$ | -10/+22<br>0/+15 or 18 | V    |
| Continuous Drain Current (Note 1)                                            | Ta= 25 °C<br>Ta= 100 °C                                              | $I_D$                            | 15.5<br>12.4           | A    |
| Drain Current-Pulse (Note 1)                                                 | Tj< 175 °C                                                           | $I_{DM}$                         | 27                     | A    |
| Maximum Power Dissipation Power                                              | Ta= 25 °C                                                            | $P_D$                            | 71                     | W    |
| Dissipation Derating Factor Above 25 °C                                      | Ta= 100 °C                                                           |                                  | 36                     |      |
| Derating Factor                                                              |                                                                      | $D_F$                            | 0.48                   | W/°C |
| Avalanche Current,Single Pulse (Note 1)                                      | L= 0.5 mH                                                            | $I_{AS}$                         | 10.0                   | A    |
| Single Pulse Avalanche Energy (Note 1)<br>Test Circuit & Waveform See Fig.22 | L= 0.5 mH<br>IAS= 10.0 A,RG= 10.0 Ω<br>Starting Tj=25 °C,VG = 18.0 V | $E_{AS}$                         | 25                     | mJ   |

### Thermal Characteristics (Ta=25°C Unless Otherwise Specified)

| Parameter                                                   | Test Conditions                                        | Symbol    | Typ.       | Unit |
|-------------------------------------------------------------|--------------------------------------------------------|-----------|------------|------|
| Junction Temperature                                        |                                                        | $T_J$     | -55 to 175 | °C   |
| Storage Temperature Range                                   |                                                        | $T_{STD}$ | -55 to 175 | °C   |
| Thermal Resistance Junction To Ambient<br>With Steady-State | Still Air Environment<br>With Ta=25 °C                 | $R_{θJA}$ | 50         | °C/W |
| Thermal Resistance Junction-Case<br>With Steady-State       | Device Mounted On<br>1 in2 FR-4 Board With 2oz. Copper | $R_{θJC}$ | 2.1        |      |

Notes: 1.Pulse Width Limited By Max. Junction Temperature. (See Fig. 19).

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**Electrical Characteristics (Ta=25°C Unless Otherwise Specified )**

| Parameter                                                | Test Conditions                  | Symbol              | Min.                | Typ. | Max. | Unit |    |    |
|----------------------------------------------------------|----------------------------------|---------------------|---------------------|------|------|------|----|----|
| Static Off Characteristics                               |                                  |                     |                     |      |      |      |    |    |
| Drain-Source Breakdown Voltage                           | VGS=0V, ID=100uA                 | BV <sub>DSS</sub>   | 750                 | --   | --   | V    |    |    |
| Zero Gate Voltage Drain Current                          | VDS= 0 V, VGS=0V, Tj=25°C        | I <sub>DSS</sub>    | --                  | 0.1  | 20   | uA   |    |    |
|                                                          | VDS= 750 V, VGS=0V, Tj=175°C     |                     | --                  | 3    | --   |      |    |    |
| Gate To Source Leakage Current                           | VGS= 22 V, VDS=0V                | I <sub>GSS</sub>    | --                  | --   | 250  | nA   |    |    |
| Source To Gate Leakage Current                           | VGS= -10 V, VDS=0V               | I <sub>SGS</sub>    | --                  | --   | 250  | nA   |    |    |
| Forward Transconductance                                 | ID= 4.7 A, VDS= 20 V             | g <sub>fs</sub>     | --                  | 3.6  | --   | S    |    |    |
| Static On Characteristics                                |                                  |                     |                     |      |      |      |    |    |
| Gate Threshold Voltage                                   | VGS= VDS, ID=10mA ,Tj=25°C       | V <sub>GS(TH)</sub> | 3                   | 4.1  | 5    | V    |    |    |
|                                                          | VGS= VDS, ID=10mA ,Tj=175°C      |                     | --                  | 3.0  | --   |      |    |    |
| Drain-Source On Resistance                               | ID= 4.7 A, VGS= 18.0 V, Tj=25°C  | R <sub>DS(ON)</sub> | --                  | 190  | 240  | mΩ   |    |    |
|                                                          | ID= 4.7 A, VGS= 18.0 V, Tj=175°C |                     | --                  | 209  | 264  |      |    |    |
|                                                          | ID= 4.7 A, VGS= 15.0 V, Tj=25°C  |                     | --                  | 247  | 360  |      |    |    |
|                                                          | ID= 4.7 A, VGS= 15.0 V, Tj=175°C |                     | --                  | 220  | 320  |      |    |    |
| Dynamic Characteristics                                  |                                  |                     |                     |      |      |      |    |    |
| Input Capacitance                                        | VDS= 650 V                       | C <sub>iss</sub>    | --                  | 294  | --   | pF   |    |    |
| Output Capacitance                                       | VGS= 0 V                         |                     | C <sub>oss</sub>    | --   | 25   |      | -- | pF |
| Reverse Transfer Capacitance                             | F= 1 MHZ                         |                     | C <sub>rss</sub>    | --   | 4    |      | -- |    |
| Gate Resistance                                          | VGS=0V, VDS=0V, Freq.=1MHz       | R <sub>g</sub>      | --                  | 25   | --   | Ω    |    |    |
| Switching Paramters (Test Circuit & Waveform See Fig.20) |                                  |                     |                     |      |      |      |    |    |
| Turn-On Delay Time                                       | VDS= 400 V<br>ID= 4.7 A          | Tj=25°C             | t <sub>d(on)</sub>  | --   | 13   | --   | ns |    |
|                                                          |                                  | Tj=175°C            |                     | --   | 12.4 |      |    | -- |
| Turn-On Rise Time                                        | VGS= 0/+18 V<br>RG= 10.0 Ω       | Tj=25°C             | t <sub>r</sub>      | --   | 8.5  | --   | ns |    |
|                                                          |                                  | Tj=175°C            |                     | --   | 8.1  |      |    | -- |
| Turn-Off Delay Time                                      | L= 600 μH                        | Tj=25°C             | t <sub>d(off)</sub> | --   | 10   | --   | ns |    |
|                                                          |                                  | Tj=175°C            |                     | --   | 9.5  |      |    | -- |
| Turn-Off Rise Time                                       |                                  | Tj=25°C             | t <sub>f</sub>      | --   | 6    | --   | ns |    |
|                                                          |                                  | Tj=175°C            |                     | --   | 5.1  |      |    | -- |
| Turn-On Switching Loss                                   |                                  | Tj=25°C             | E <sub>on</sub>     | --   | 20.0 | --   | μJ |    |
|                                                          |                                  | Tj=175°C            |                     | --   | 19.0 |      |    | -- |
| Turn-Off Switching Loss                                  |                                  | Tj=25°C             | E <sub>off</sub>    | --   | 14.9 | --   | μJ |    |
|                                                          |                                  | Tj=175°C            |                     | --   | 13.6 |      |    | -- |
| Total Switching Energy                                   |                                  | Tj=25°C             | E <sub>tot</sub>    | --   | 34.9 | --   | μJ |    |
|                                                          |                                  | Tj=175°C            |                     | --   | 32.6 |      |    | -- |

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**Electrical Characteristics (Ta=25°C Unless Otherwise Specified )**

| Parameter                                                                                              | Test Conditions                                        | Symbol    | Min. | Typ.         | Max. | Unit |
|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-----------|------|--------------|------|------|
| <b>Gate Charge Paramters (Test Circuit &amp; Waveform See Fig.21)</b>                                  |                                                        |           |      |              |      |      |
| Total Gate Charge                                                                                      | VDS= 400 V                                             | $Q_g$     | --   | 12           | --   | nC   |
| Gate-Source Charge                                                                                     | VGS= 0/+18 V                                           | $Q_{gs}$  | --   | 4            | --   | nC   |
| Gate-Drain Charge                                                                                      | ID= 4.7 A                                              | $Q_{gd}$  | --   | 1.5          | --   | nC   |
| <b>Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit &amp; Waveform See Fig.23)</b> |                                                        |           |      |              |      |      |
| Max. Diode Forward Cuurent                                                                             | Tj= 25 °C                                              | $I_s$     | --   | --           | 15.5 | A    |
| tp Limited by Tj(max)                                                                                  | Tj= 100 °C                                             |           | --   | --           | 12.4 |      |
| Max. Pulsed Forward Cuurent                                                                            |                                                        | $I_{SM}$  | --   | --           | 23   | A    |
| Diode Forward Voltage                                                                                  | ID= 2.8 A, VGS=-0V<br>Tj=25°C<br>Tj=175°C              | $V_{SD}$  | --   | 3.3<br>2.8   | --   | V    |
| Reverse Recovery Time                                                                                  | IS= 7.8 A<br>di/dt= 1000.0 A/us<br>Tj=25°C<br>Tj=175°C | $t_{rr}$  | --   | 9.8<br>11.1  | --   | ns   |
| Reverse Recovery Charge                                                                                | VGS= 0.0 V<br>VDS= 400 V<br>Tj=25°C<br>Tj=175°C        | $Q_{rr}$  | --   | 32<br>36.8   | --   | nC   |
| Reverse Recovery Current                                                                               | Tj=25°C<br>Tj=175°C                                    | $I_{rrm}$ | --   | 7.0<br>6.6   | --   | A    |
| Reverse Recovery Energy                                                                                | Tj=25°C<br>Tj=175°C                                    | $E_{rr}$  | --   | 13.7<br>14.6 | --   | μJ   |

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Typical Characteristics Curves

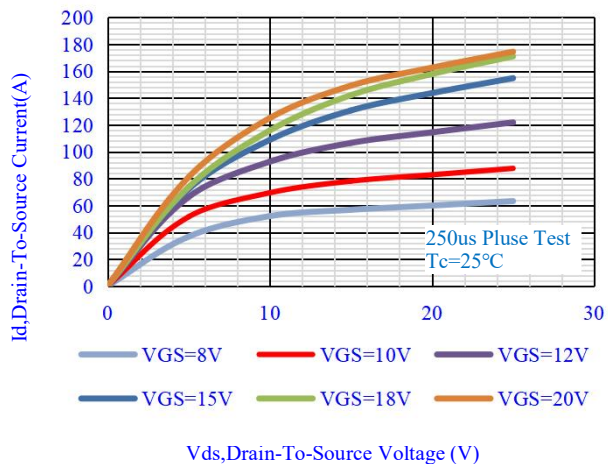


Fig.1-Output Characteristics@Tj=25°C

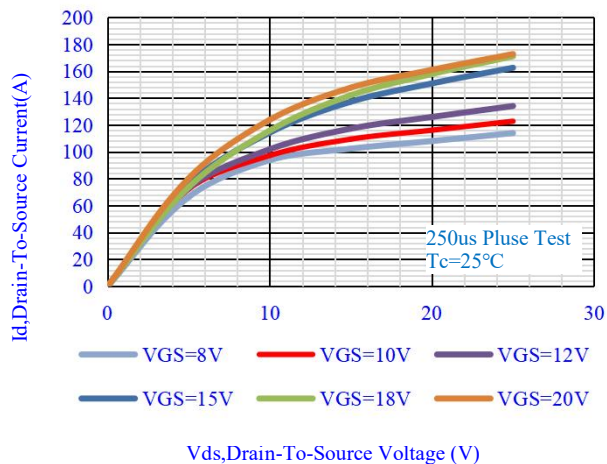


Fig.2-Output Characteristics@Tj=175°C

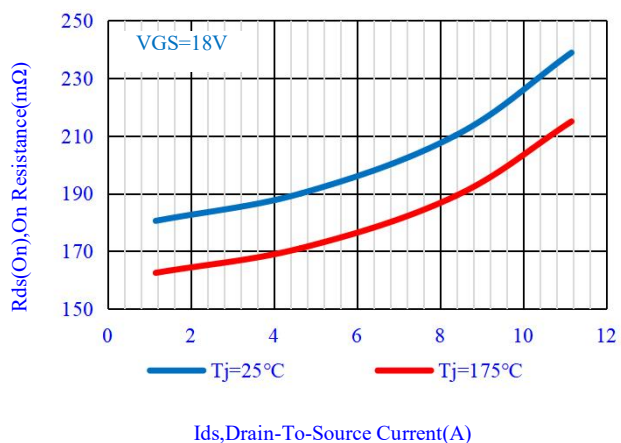


Fig.3-On Resistance Vs. Drain Current

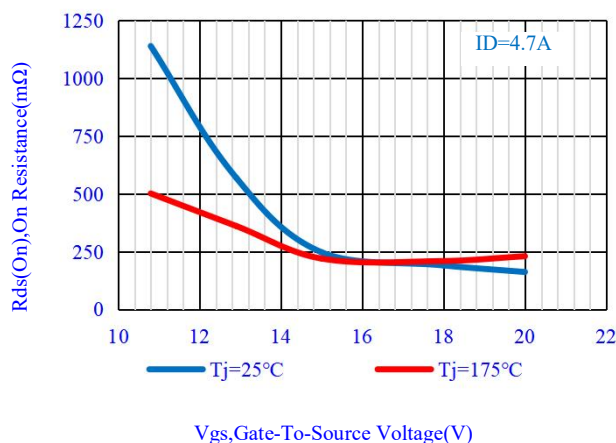


Fig.4-On Resistance Vs. Gate Source Voltage

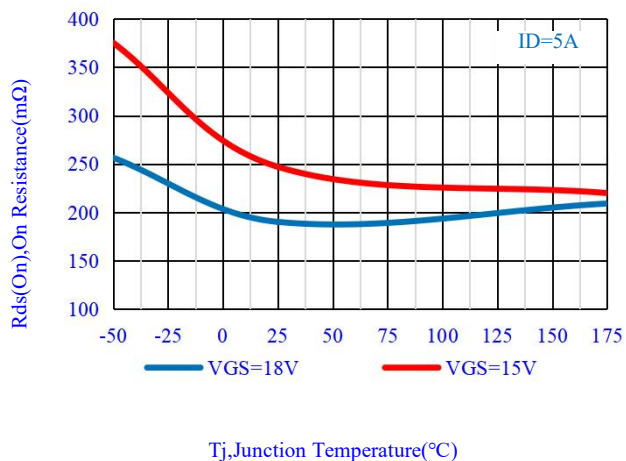


Fig.5-On Resistance Vs. Junction Temperature

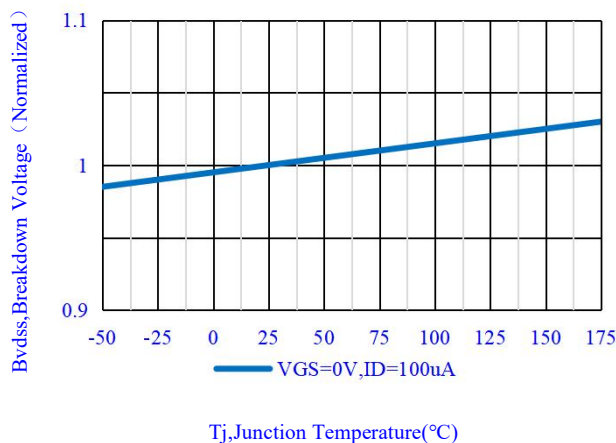


Fig.6-Breakdown Voltage Vs. Junction Temperature

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Typical Characteristics Curves

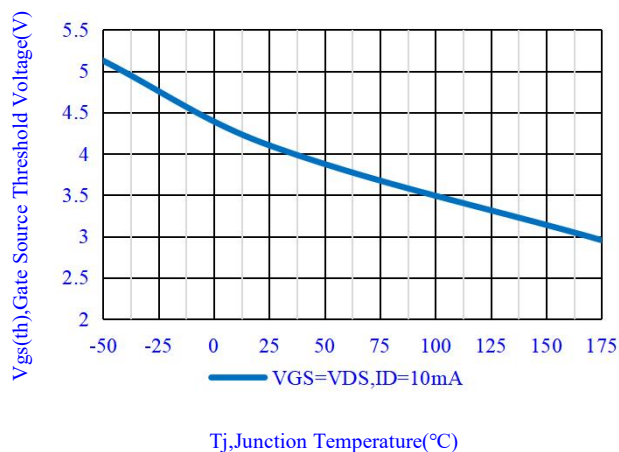


Fig.7-Gate Source Threshold Voltage Vs. Junction Temperature

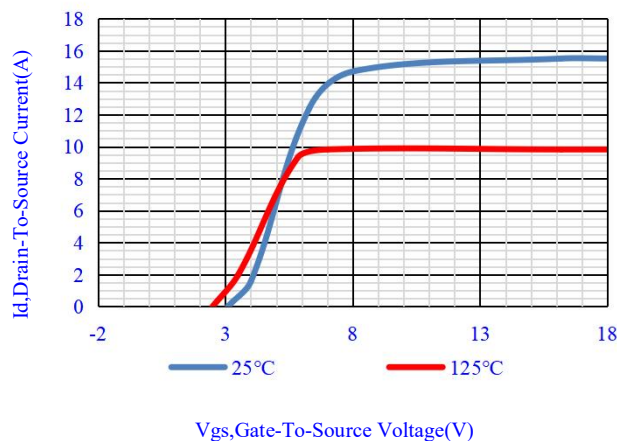


Fig.8-Transfer Characteristics

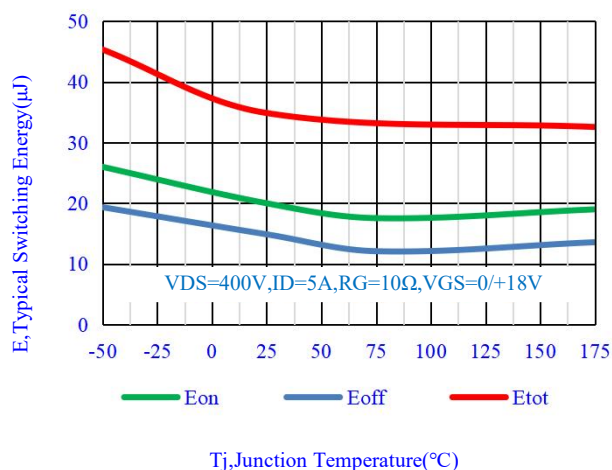


Fig.9-Typical Switching Energy Vs. Junction Temperature

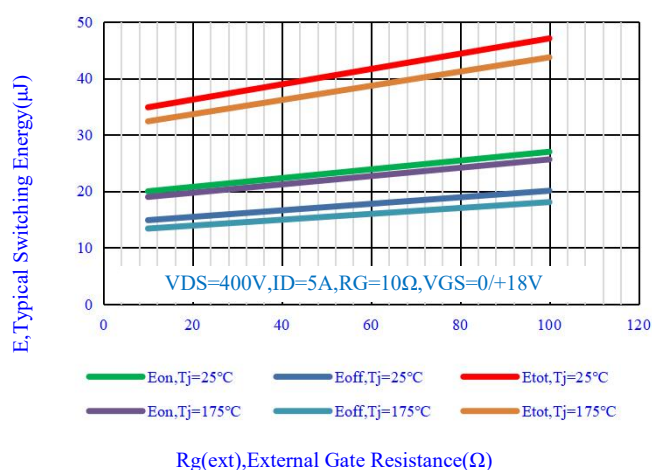


Fig.10-Typical Switching Energy Vs. External Gate Resistance

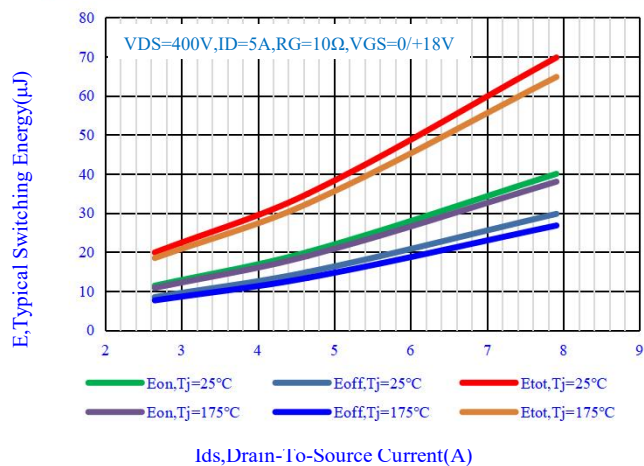


Fig.11-Typical Switching Energy Vs. Drain Source Current

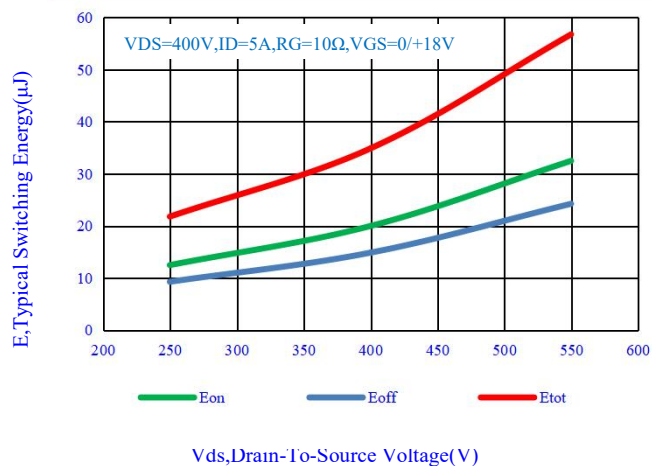


Fig.12-Typical Switching Energy Vs. Drain Source Voltage

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Typical Characteristics Curves

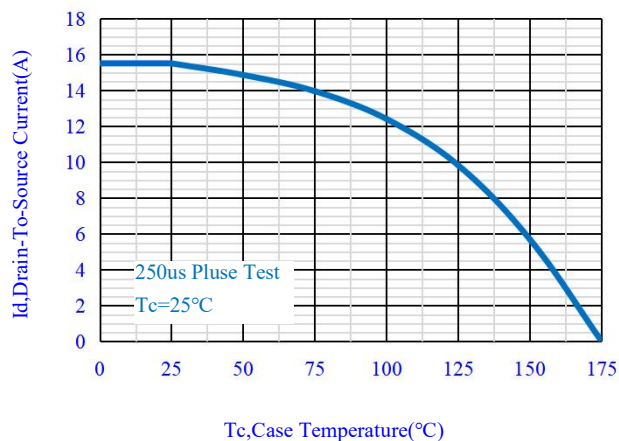


Fig.13-Maximum Continuous Drain Current Vs. Case Temperature

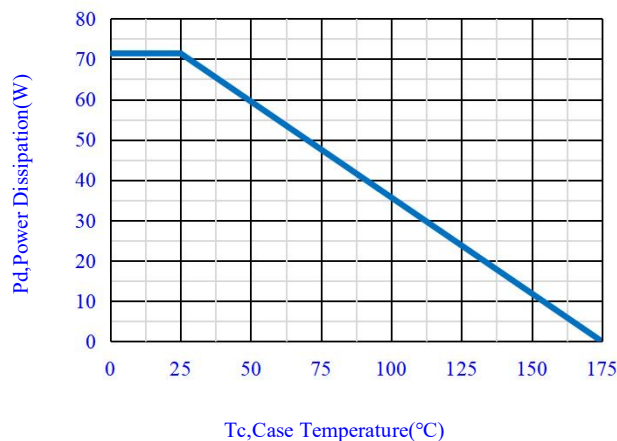


Fig.14-Maximum Power Dissipation Vs. Case Temperature

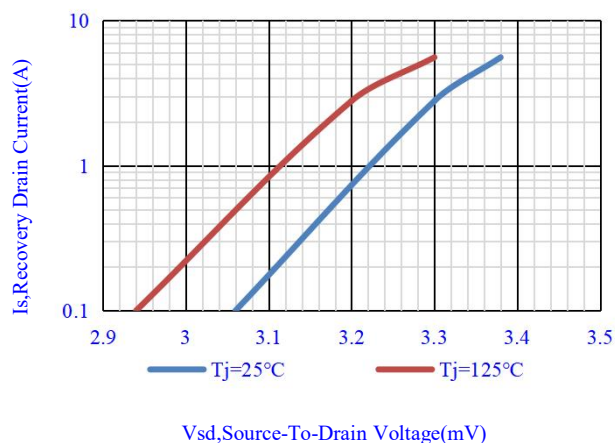


Fig.15-Source-To-Drain Diode Forward Voltage

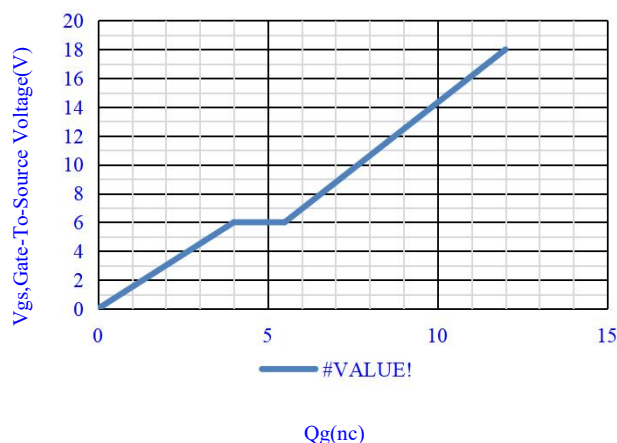


Fig.16-Gate Charge Waveform

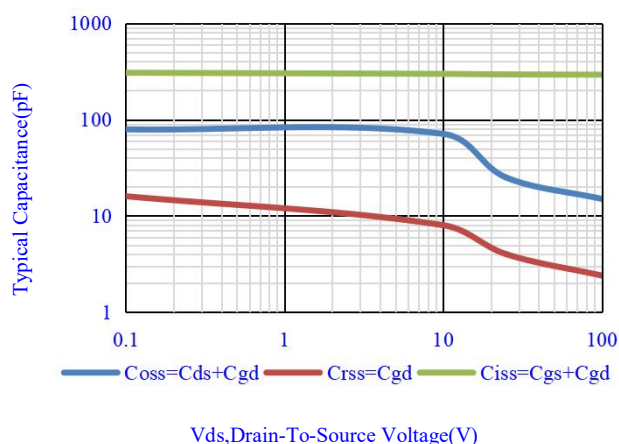


Fig.17-Typical Capacitance Vs. Drain-To-Source Voltage

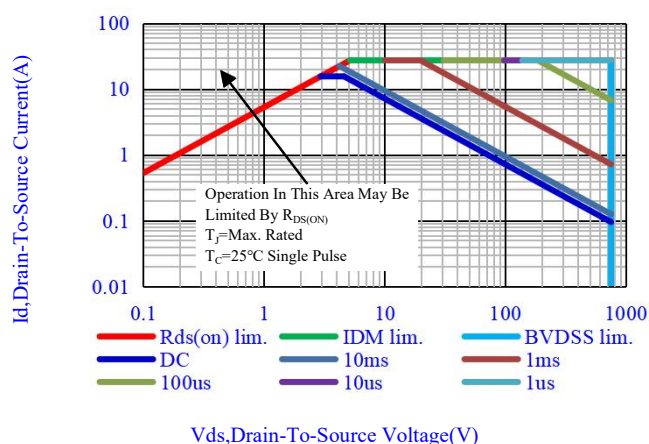


Fig.18-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

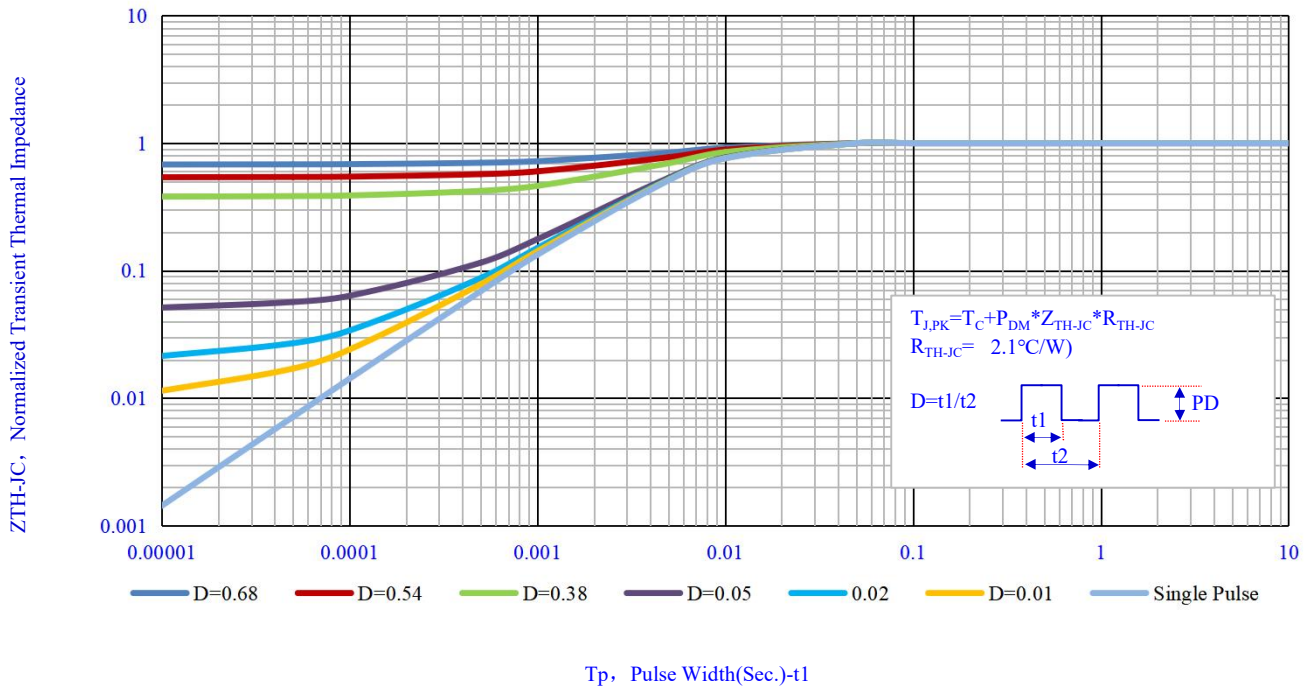


Fig.19- Normalized Maximum Transient Thermal Impedance Vs.Pulse Width

Test Circuit & Waveform

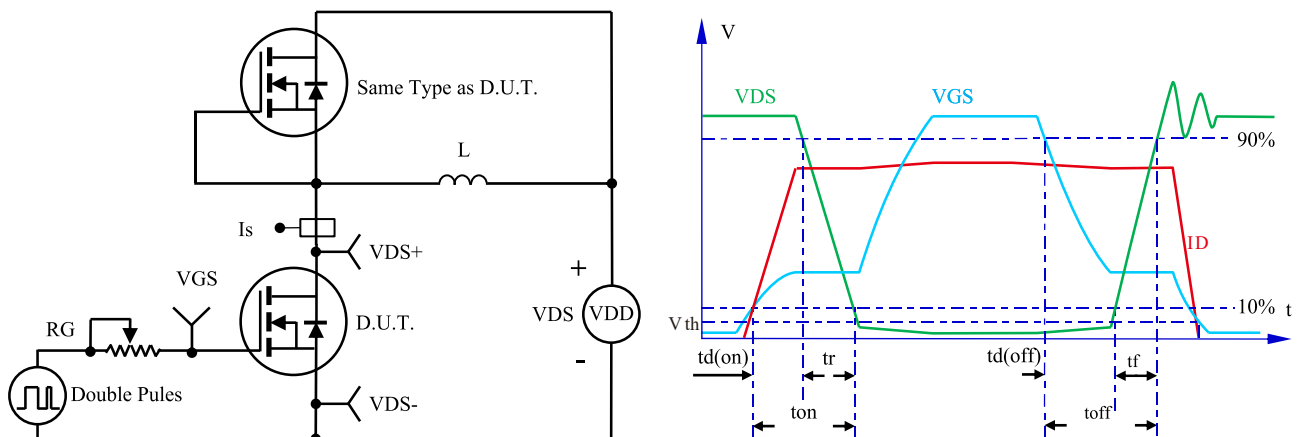


Fig.20- Inductive Switching Test Circuit & Waveform

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Test Circuit & Waveform

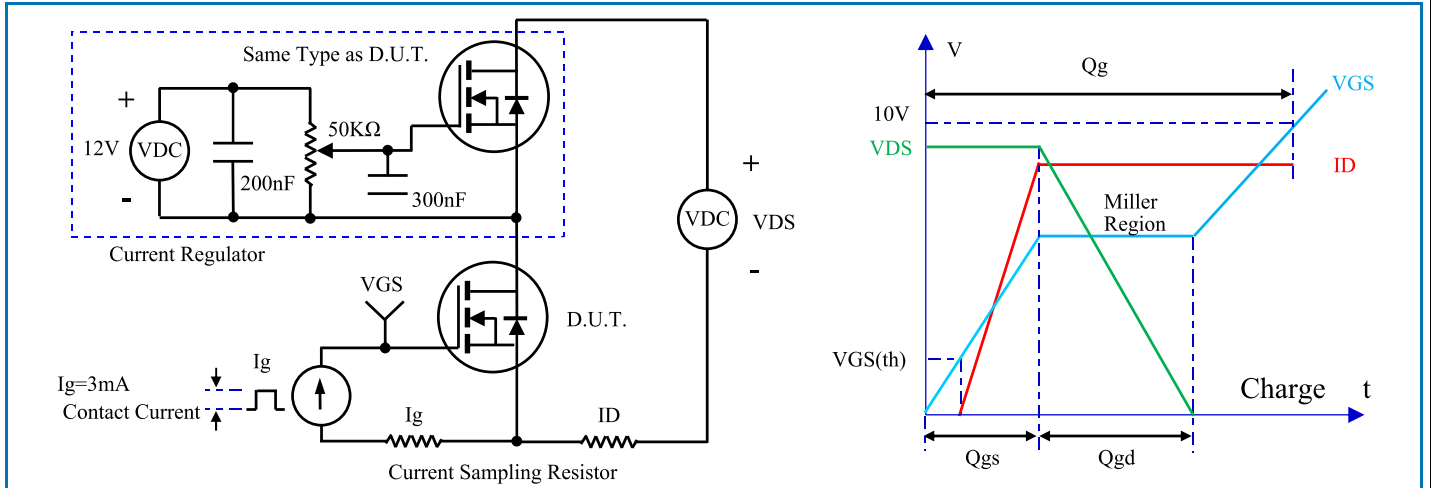


Fig.21-Gate Charge Test Circuit & Waveform

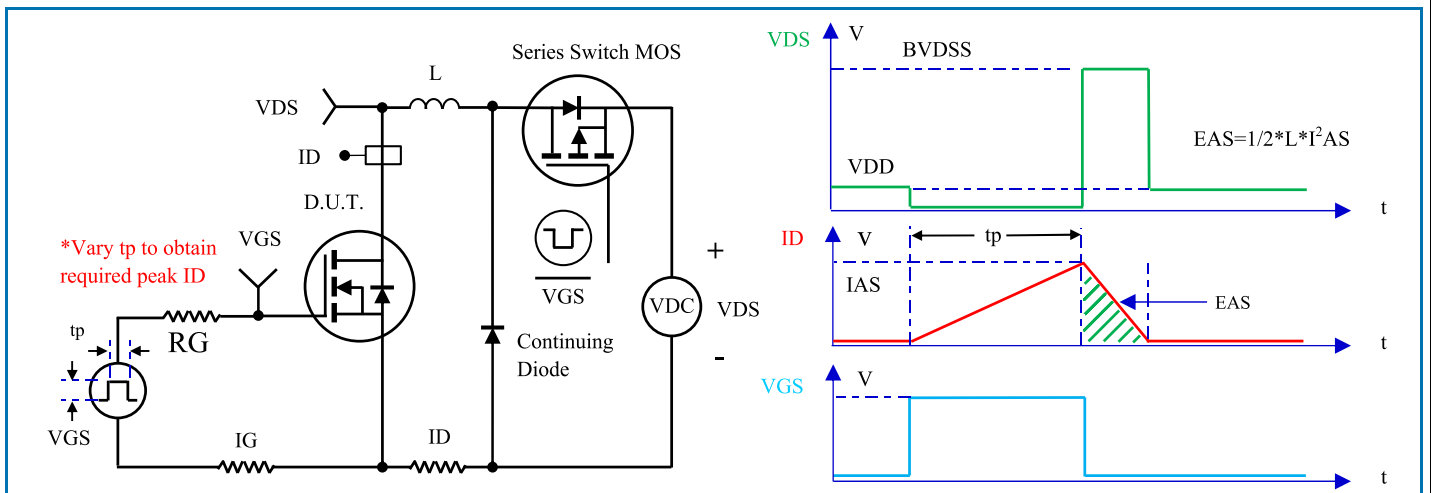


Fig.22- Unclamped Inductive Switching (UIS) Test Circuit & Waveform

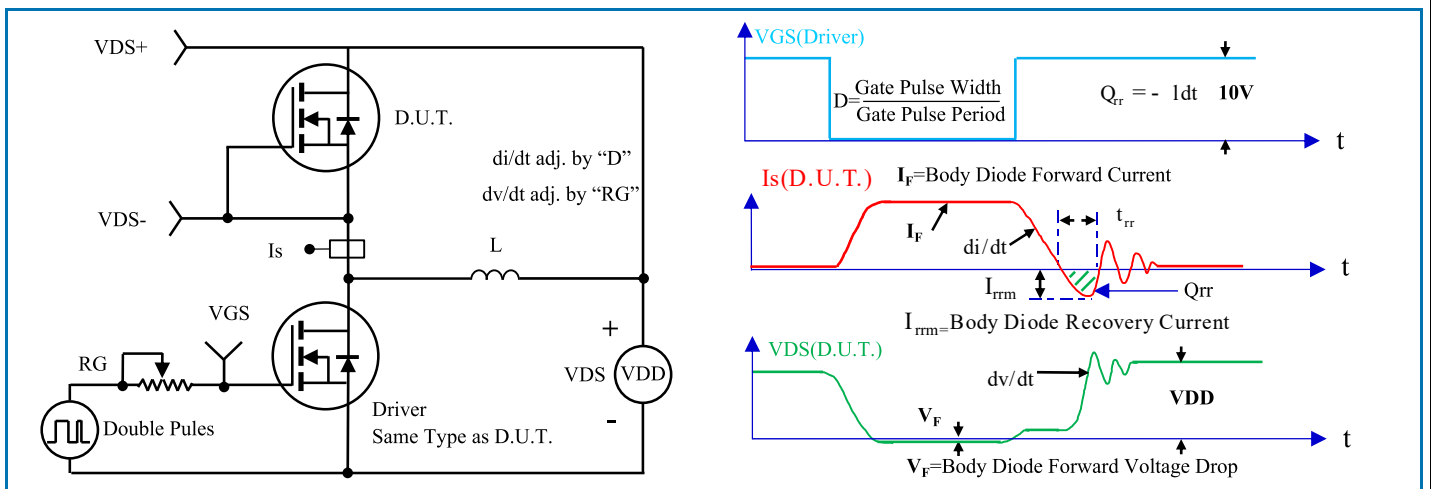


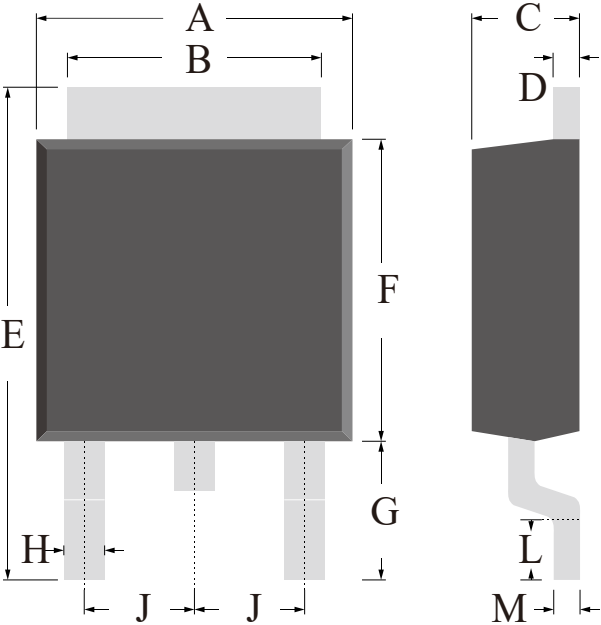
Fig.23- Diode Recovery Test Circuit & Waveform

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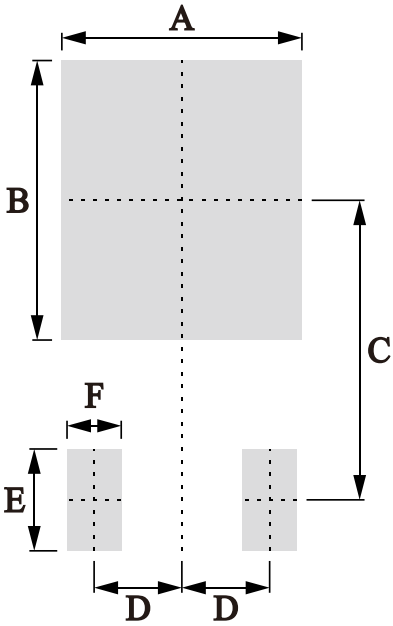
OUTLINE DRAWINGS



TO-252

| OUTLINE DIMENSIONS |            |      |       |        |      |        |
|--------------------|------------|------|-------|--------|------|--------|
| Dim.               | Milimeters |      |       | Inches |      |        |
|                    | Min.       | Typ. | Max.  | Min.   | Typ. | Max.   |
| A                  | 6.10       | -    | 7.10  | 0.2402 | -    | 0.2795 |
| B                  | 4.80       | -    | 5.80  | 0.1890 | -    | 0.2283 |
| C                  | 1.95       | -    | 2.55  | 0.0768 | -    | 0.1004 |
| D                  | 0.35       | -    | 0.75  | 0.0138 | -    | 0.0295 |
| E                  | 9.25       | -    | 10.75 | 0.3642 | -    | 0.4232 |
| F                  | 5.60       | -    | 6.60  | 0.2205 | -    | 0.2598 |
| G                  | 2.50       | -    | 3.10  | 0.0984 | -    | 0.1220 |
| H                  | 0.65       | -    | 1.05  | 0.0256 | -    | 0.0413 |
| J                  | 2.10       | -    | 2.50  | 0.0827 | -    | 0.0984 |
| L                  | 1.00       | -    | 1.40  | 0.0394 | -    | 0.0551 |
| M                  | 0.35       | -    | 0.75  | 0.0138 | -    | 0.0295 |

RECOMMEDND LAYOUT DRAWINGS



TO-252

| OUTLINE DIMENSIONS |            |      |      |        |        |      |
|--------------------|------------|------|------|--------|--------|------|
| Dim.               | Milimeters |      |      | Inches |        |      |
|                    | Min.       | Typ. | Max. | Min.   | Typ.   | Max. |
| A                  | -          | 6.09 | -    | -      | 0.2398 | -    |
| B                  | -          | 7.57 | -    | -      | 0.2980 | -    |
| C                  | -          | 6.64 | -    | -      | 0.2614 | -    |
| D                  | -          | 2.30 | -    | -      | 0.0906 | -    |
| E                  | -          | 2.76 | -    | -      | 0.1087 | -    |
| F                  | -          | 1.42 | -    | -      | 0.0559 | -    |

## NCH75R190S

N-Channel Silicon Carbide MOSFET



### MARKING INFORMATION



### MARKING INSTRUCTIONS

NH=Niuhang Trademark

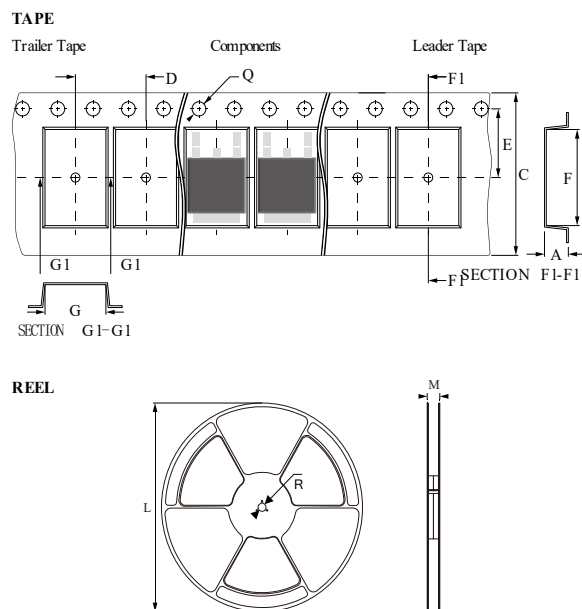
FF=Product Line Code,According To Actual Changes

YWW=Date Code,According To Actual Changes

LLWWF=Internal Code,According To Actual Changes

NCH75R190S=Model

### PACKAGING



### TO-252

| OUTLINE DIMENSIONS |            |      |        |        |      |        |
|--------------------|------------|------|--------|--------|------|--------|
| Dim.               | Milimeters |      |        | Inches |      |        |
|                    | Min.       | Typ. | Max.   | Min.   | Typ. | Max.   |
| TAPE               |            |      |        |        |      |        |
| A                  | 2.60       | -    | 2.80   | 0.1024 | -    | 0.1102 |
| C                  | 15.60      | -    | 16.40  | 0.6142 | -    | 0.6457 |
| D                  | 7.70       | -    | 8.30   | 0.3031 | -    | 0.3268 |
| E                  | 7.30       | -    | 7.70   | 0.2874 | -    | 0.3031 |
| F                  | 10.20      | -    | 10.80  | 0.4016 | -    | 0.4252 |
| G                  | 6.70       | -    | 7.10   | 0.2638 | -    | 0.2795 |
| Q Φ                | 1.40       | -    | 1.60   | 0.0551 | -    | 0.0630 |
| REEL               |            |      |        |        |      |        |
| L                  | 328.00     | -    | 332.00 | 12.913 | -    | 13.071 |
| R                  | 12.00      | -    | 14.00  | 0.4724 | -    | 0.5512 |
| M                  | 19.40      | -    | 23.40  | 0.7638 | -    | 0.9213 |

### PACKING INFORMATION

| Package Type | Package Code | Product Weight Approx(g/Pcs) | Package Method | Quantity (Pcs/Min. Pack.) | Quantity (Pcs/Inner Box) | Quantity (Pcs/Carton) |
|--------------|--------------|------------------------------|----------------|---------------------------|--------------------------|-----------------------|
| TO-252       | P1           | 0.321                        | 13" Reel       | 2500                      | 5000                     | 30000                 |
| TO-252       | P2           | 0.321                        | 13" Reel       | 2500                      | 2500                     | 25000                 |

**NCH75R190S**

**N-Channel Silicon Carbide MOSFET**



**Recommended wave soldering condition**

| Product         | Peak Temperature | Soldering Time  |
|-----------------|------------------|-----------------|
| Pb-free devices | 260 +0/-5 °C     | 5 +1/-1 seconds |

**Recommended temperature profile for IR reflow**

|  | Profile feature                                                                          | Sn-Pb eutectic Assembly          | Pb-free Assembly                 |
|--|------------------------------------------------------------------------------------------|----------------------------------|----------------------------------|
|  | Average ramp-up rate (TSmax to TP)                                                       | 3°C/second max.                  | 3°C/second max.                  |
|  | Preheat-Temperature Min (TS min)<br>-Temperature Max (TS max)<br>-Time(ts min to ts max) | 100°C<br>150°C<br>60-120 seconds | 150°C<br>200°C<br>60-180 seconds |
|  | Time maintained above:<br>-Temperature (TL)<br>- Time (tL)                               | 183°C<br>60-150 seconds          | 217°C<br>60-150 seconds          |
|  | Peak Temperature(TP)                                                                     | 240 +0/-5 °C                     | 260 +0/-5 °C                     |
|  | Time within 5°C of actual peak temperature (tp)                                          | 10-30 seconds                    | 20-40 seconds                    |
|  | Ramp down rate                                                                           | 6°C/second max.                  | 6°C/second max.                  |
|  | Time 25 °C to peak temperature                                                           | 6 minutes max.                   | 8 minutes max.                   |

Note : All temperatures refer to topside of the package, measured on the package body surface.

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NCH75R190S

N-Channel Silicon Carbide MOSFET



Specification Revision History

| Rev. | Date       | Changed Items | Pre-Changed Content | Changed Content |
|------|------------|---------------|---------------------|-----------------|
| A/1  | 2025-10-20 | First Issue   |                     |                 |
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