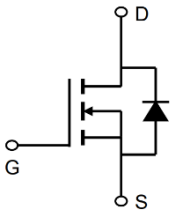
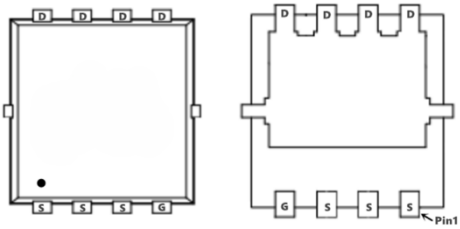
# LM5D70N03

## 30V N-Channel Enhancement Mode MOSFET

## Description

The LM5D70N03 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.




## General Features

$V_{DS}$ = 30V $I_D$ =70A

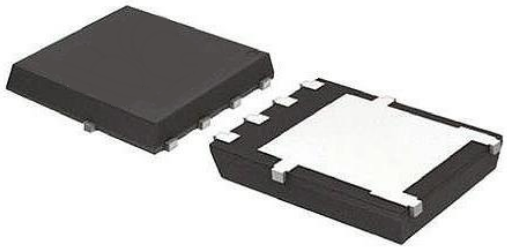
$R_{DS(ON)}$ < 5.5mΩ @ $V_{GS}$=10V

## Application

Battery protection

Load switch

Uninterruptible power supply



## Package Marking and Ordering Information

| Device | Device Marking | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| LM5D70N03 | AP70N03NF | DFN5X6-8 | - | - | 5000 units |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 30 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 70 | A |
| $I_D$@$T_C$=100℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 51 | A |
| $I_D$@$T_A$=25℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 15 | A |
| $I_D$@$T_A$=70℃ | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 12 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 160 | A |
| EAS | Single Pulse Avalanche Energy[3] | 115.2 | mJ |
| $I_{AS}$ | Avalanche Current | 48 | A |
| $P_D$@$T_C$=25℃ | Total Power Dissipation[4] | 59 | W |
| $P_D$@$T_A$=25℃ | Total Power Dissipation[4] | 2 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | 62 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | 2.1 | ℃/W |

## Electrical Characteristics ($T_J$=25℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BVDSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 30 | --- | --- | V |
| △BVDSS/△TJ | BVDSS Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.028 | --- | V/℃ |
| RDS(ON) | Static Drain-Source On-Resistance | $V_{GS}$=10V , $I_D$=30A | --- | 3.5 | 5.5 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=15A | --- | 6.5 | 8.5 | |
| VGS(th) | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.0 | 1.6 | 2.5 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -6.16 | --- | mV/℃ |
| IDSS | Drain-Source Leakage Current | $V_{DS}$=24V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=24V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 | |
| IGSS | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=30A | --- | 22 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 1.7 | 3.4 | Ω |
| $Q_g$ | Total Gate Charge (4.5V) | $V_{DS}$=15V , $V_{GS}$=4.5V , $I_D$=15A | --- | 20 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 7.6 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 7.2 | --- | |
| Td(on) | Turn-On Delay Time | $V_{DD}$=15V , $V_{GS}$=10V , $R_G$=3.3Ω $I_D$=15A | --- | 7.8 | --- | ns |
| $T_r$ | Rise Time | | --- | 15 | --- | |
| Td(off) | Turn-Off Delay Time | | --- | 37.3 | --- | |
| $T_f$ | Fall Time | | --- | 10.6 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , f=1MHz | --- | 2295 | --- | pF |
| Coss | Output Capacitance | | --- | 267 | --- | |
| Crss | Reverse Transfer Capacitance | | --- | 210 | --- | |
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | 80 | A |
| ISM | Pulsed Source Current[2,5] | | --- | --- | 160 | A |
| VSD | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1 | V |
| $t_{rr}$ | Reverse Recovery Time | IF=30A , dI/dt=100A/μs ,$T_J$=25℃ | --- | 14 | --- | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | --- | 5 | --- | nC |

Note :

1.The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.

2.The data tested by pulsed , pulse width .The EAS data shows Max. rating .

3.The test cond≦ 300us , duty cycle ition is $V_{DD=25}$≦V,V 2%$_{GS}$ =10V,L=0.1mH,$I_{AS}$=53.8A

4.The power dissipation is limited by 175℃ junction temperature

5.The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.

## Typical Electrical and Thermal Characteristics

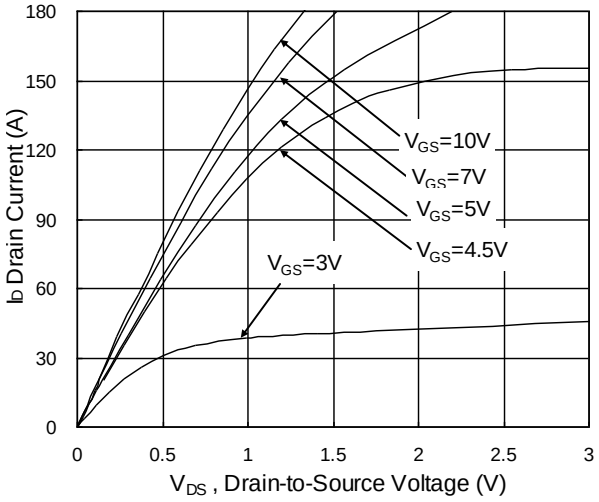



**Fig.1 Typical Output Characteristics**

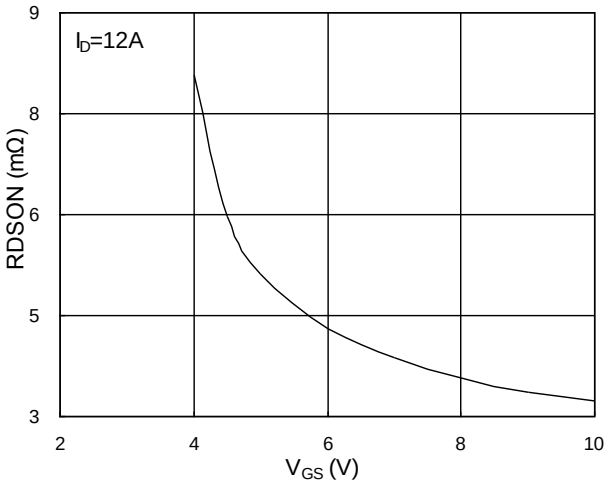



**Fig.2 On-Resistance vs. G-S Voltage**

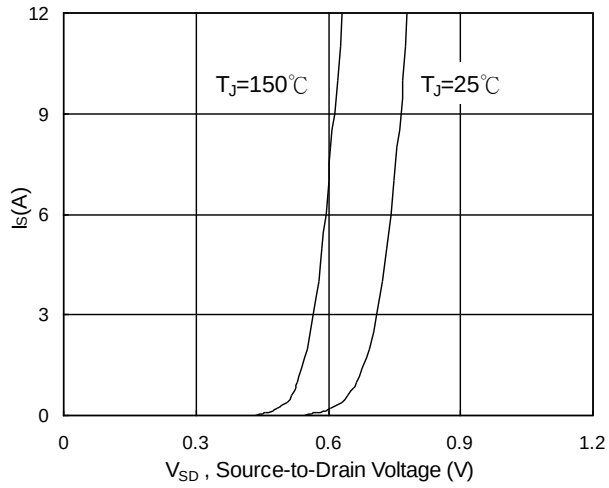



**Fig.3 Forward Characteristics of Reverse**

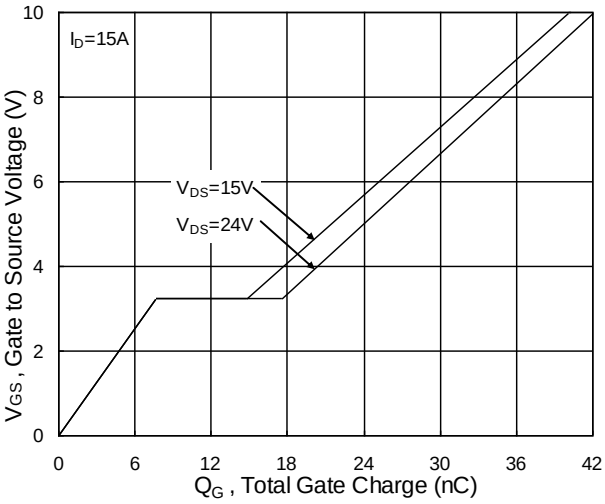



**Fig.4 Gate-Charge Characteristics**

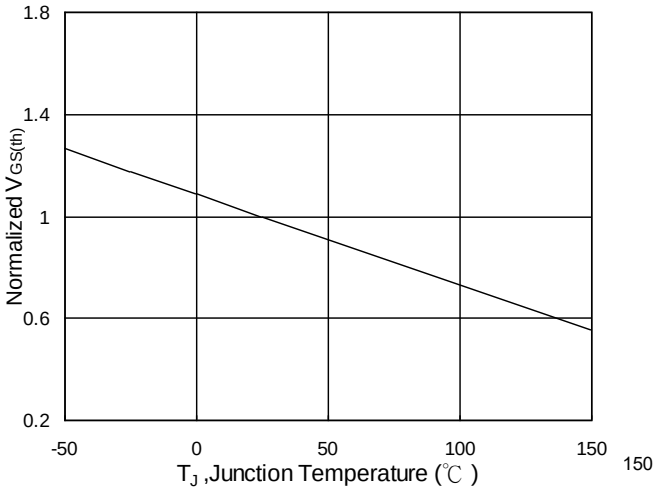



**Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$**

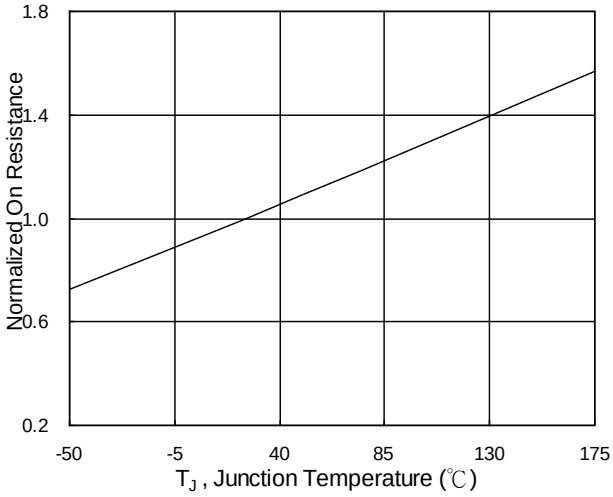



**Fig.6 Normalized $R_{DSON}$ vs. $T_J$**

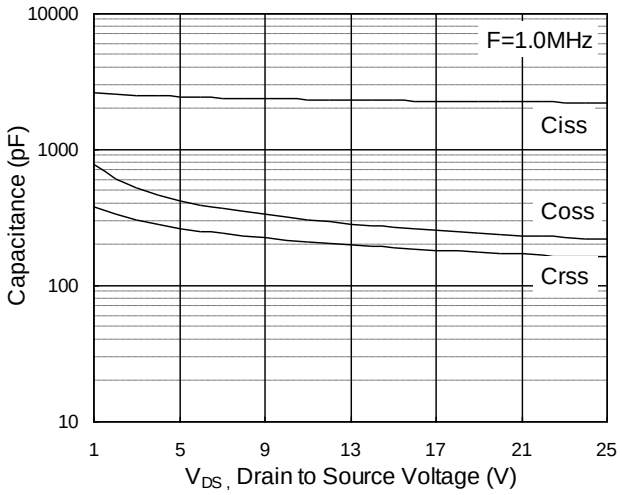



**Fig.7 Capacitance**

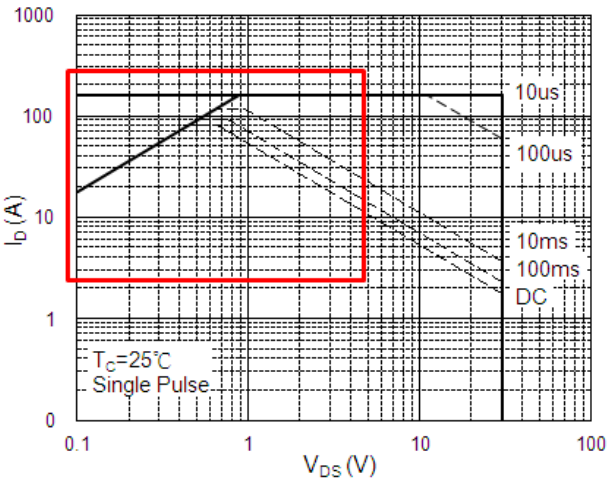



**Fig.8 Safe Operating Area**

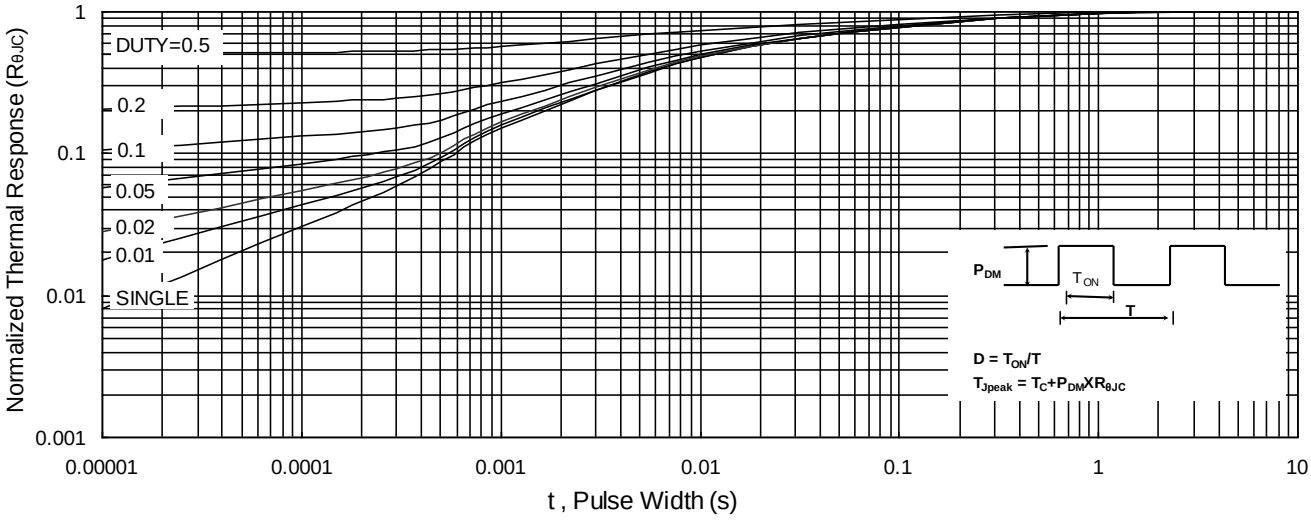



**Fig.9 Normalized Maximum Transient Thermal Impedance**

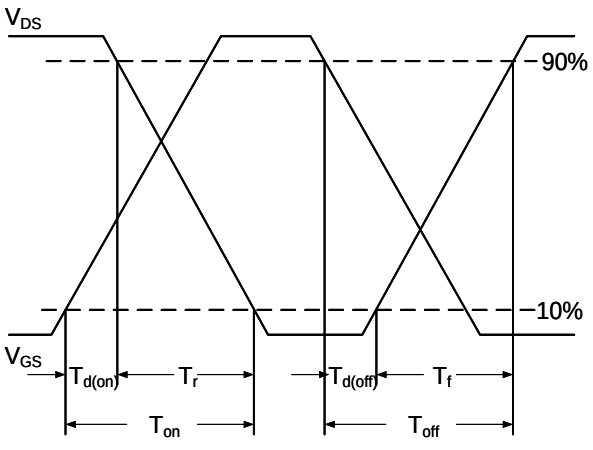



**Fig.10 Switching Time Waveform**

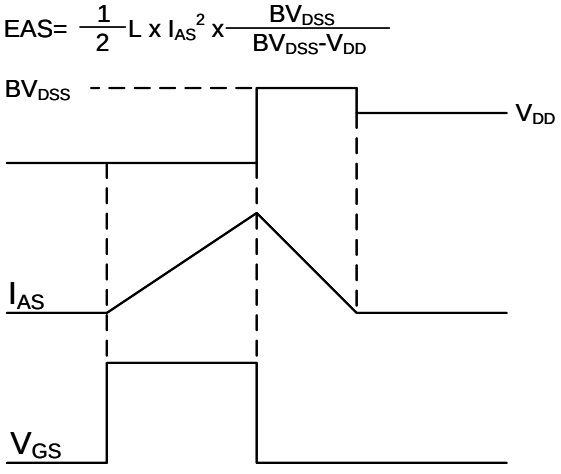
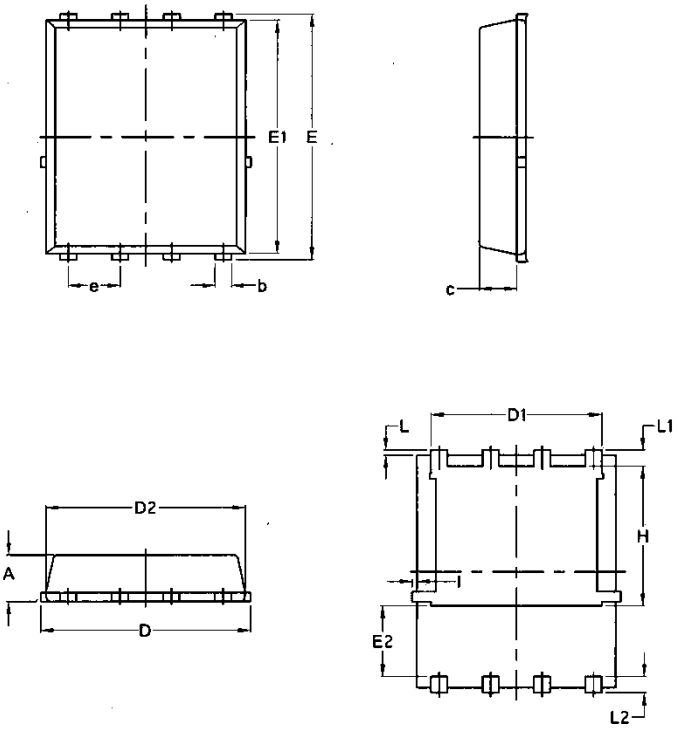



**Fig.11 Unclamped Inductive Switching Waveform**

## Package Mechanical Data-DFN5*6-8-JQ Single




| Symbol | Common | | | |
|---|---|---|---|---|
| | mm | | Inch | |
| | Mim | Max | Min | Max |
| A | 1.03 | 1.17 | 0.0406 | 0.0461 |
| b | 0.34 | 0.48 | 0.0134 | 0.0189 |
| c | 0.824 | 0.0970 | 0.0324 | 0.082 |
| D | 4.80 | 5.40 | 0.1890 | 0.2126 |
| D1 | 4.11 | 4.31 | 0.1618 | 0.1697 |
| D2 | 4.80 | 5.00 | 0.1890 | 0.1969 |
| E | 5.95 | 6.15 | 0.2343 | 0.2421 |
| E1 | 5.65 | 5.85 | 0.2224 | 0.2303 |
| E2 | 1.60 | / | 0.0630 | / |
| e | 1.27 BSC | | 0.05 BSC | |
| L | 0.05 | 0.25 | 0.0020 | 0.0098 |
| L1 | 0.38 | 0.50 | 0.0150 | 0.0197 |
| L2 | 0.38 | 0.50 | 0.0150 | 0.0197 |
| H | 3.30 | 3.50 | 0.1299 | 0.1378 |
| I | / | 0.18 | / | 0.0070 |

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