# MCH6660

## Power MOSFET

### 20V, 136mΩ, 2A, −20V, 266mΩ, −1.5A Complementary Dual

ON Semiconductor®

www.onsemi.com

## Features

- ON-resistance Nch : $R_{DS}(on)1$=105mΩ(typ.)
  Pch : $R_{DS}(on)1$=205mΩ(typ.)
- Pb-Free, Halogen Free and RoHS Compliance
- Ultrasmall Package MCPH6(2.0mm×2.1mm×0.85mmt)
- Nch MOSFET and Pch MOSFET are put in MCPH6 Package
- 1.8V Drive
- ESD Diode - Protected Gate

## Applications

- General-Purpose Switching Device Applications

## Specifications

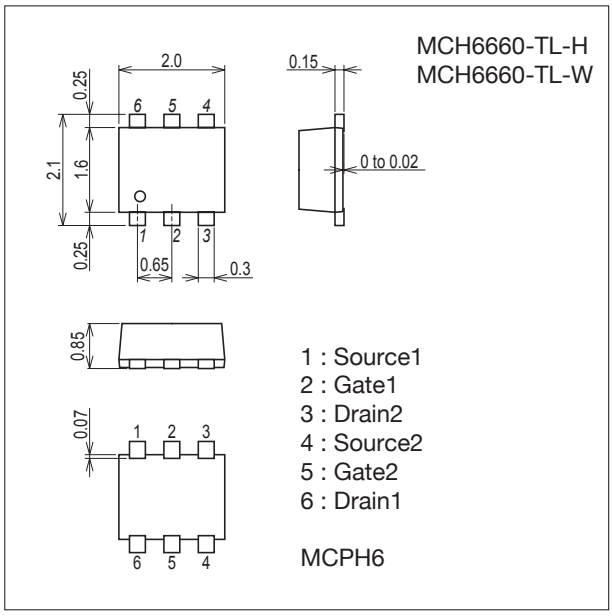
### Absolute Maximum Ratings at Ta=25°C

| Parameter | Symbol | Conditions | N-channel | P-channel | Unit |
|---|---|---|---|---|---|
| Drain-to-Source Voltage | $V_{DSS}$ | | 20 | −20 | V |
| Gate-to-Source Voltage | $V_{GSS}$ | | ±10 | ±10 | V |
| Drain Current (DC) | $I_D$ | | 2 | −1.5 | A |
| Drain Current (Pulse) | $I_{DP}$ | PW≤10μs, duty cycle≤1% | 8 | −6 | A |
| Power Dissipation | $P_D$ | When mounted on ceramic substrate (900mm²×0.8mm) 1unit | 0.8 | | W |
| Junction Temperature | Tj | | 150 | | °C |
| Storage Temperature | Tstg | | −55 to +150 | | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### Package Dimensions

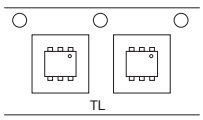
unit : mm (typ)
7022A-006



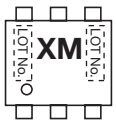

### Product & Package Information

- Package : MCPH6
- JEITA, JEDEC : SC-88, SC-70-6, SOT-363
- Minimum Packing Quantity : 3,000 pcs./reel

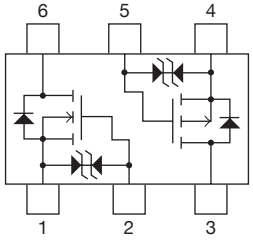
### Packing Type : TL




### Marking




### Electrical Connection




**ORDERING INFORMATION**

See detailed ordering and shipping information on page 8 of this data sheet.

## Electrical Characteristics at Ta=25°C

| Parameter | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| [N-channel] | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D$=1mA, $V_{GS}$=0V | 20 | | | V |
| Zero-Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=20V, $V_{GS}$=0V | | | 1 | μA |
| Gate-to-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±8V, $V_{DS}$=0V | | | ±10 | μA |
| Gate Threshold Voltage | $V_{GS}(th)$ | $V_{DS}$=10V, $I_D$=1mA | 0.4 | | 1.3 | V |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=10V, $I_D$=1A | | 1.9 | | S |
| Static Drain-to-Source On-State Resistance | $R_{DS}(on)1$ | $I_D$=1A, $V_{GS}$=4.5V | | 105 | 136 | mΩ |
| | $R_{DS}(on)2$ | $I_D$=0.5A, $V_{GS}$=2.5V | | 147 | 205 | mΩ |
| | $R_{DS}(on)3$ | $I_D$=0.3A, $V_{GS}$=1.8V | | 212 | 318 | mΩ |
| Input Capacitance | Ciss | $V_{DS}$=10V, f=1MHz | | 128 | | pF |
| Output Capacitance | Coss | | | 28 | | pF |
| Reverse Transfer Capacitance | Crss | | | 21 | | pF |
| Turn-ON Delay Time | $t_d(on)$ | See specified Test Circuit. | | 5.1 | | ns |
| Rise Time | $t_r$ | | | 11 | | ns |
| Turn-OFF Delay Time | $t_d(off)$ | | | 14.5 | | ns |
| Fall Time | $t_f$ | | | 12 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=10V, $V_{GS}$=4.5V, $I_D$=2A | | 1.8 | | nC |
| Gate-to-Source Charge | Qgs | | | 0.3 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | | | 0.55 | | nC |
| Forward Diode Voltage | $V_{SD}$ | $I_S$=2A, $V_{GS}$=0V | | 0.85 | 1.2 | V |
| [P-channel] | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D$=−1mA, $V_{GS}$=0V | −20 | | | V |
| Zero-Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=−20V, $V_{GS}$=0V | | | −1 | μA |
| Gate-to-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±8V, $V_{DS}$=0V | | | ±10 | μA |
| Gate Threshold Voltage | $V_{GS}(th)$ | $V_{DS}$=−10V, $I_D$=−1mA | −0.4 | | −1.4 | V |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=−10V, $I_D$=−750mA | | 1.9 | | S |
| Static Drain-to-Source On-State Resistance | $R_{DS}(on)1$ | $I_D$=−750mA, $V_{GS}$=−4.5V | | 205 | 266 | mΩ |
| | $R_{DS}(on)2$ | $I_D$=−300mA, $V_{GS}$=−2.5V | | 295 | 413 | mΩ |
| | $R_{DS}(on)3$ | $I_D$=−100mA, $V_{GS}$=−1.8V | | 430 | 645 | mΩ |
| Input Capacitance | Ciss | $V_{DS}$=−10V, f=1MHz | | 120 | | pF |
| Output Capacitance | Coss | | | 26 | | pF |
| Reverse Transfer Capacitance | Crss | | | 20 | | pF |
| Turn-ON Delay Time | $t_d(on)$ | See specified Test Circuit. | | 5.3 | | ns |
| Rise Time | $t_r$ | | | 9.7 | | ns |
| Turn-OFF Delay Time | $t_d(off)$ | | | 16 | | ns |
| Fall Time | $t_f$ | | | 14 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=−10V, $V_{GS}$=−4.5V, $I_D$=−1.5A | | 1.7 | | nC |
| Gate-to-Source Charge | Qgs | | | 0.28 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | | | 0.47 | | nC |
| Forward Diode Voltage | $V_{SD}$ | $I_S$=−1.5A, $V_{GS}$=0V | | −0.89 | −1.2 | V |

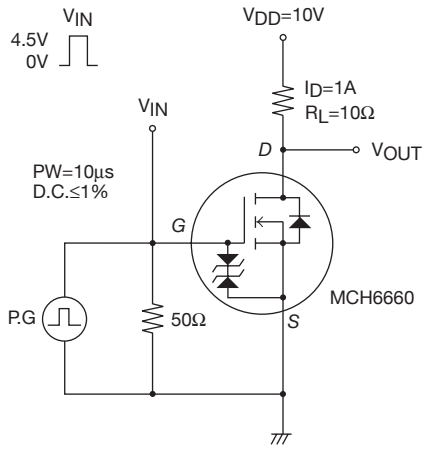
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## Thermal Resistance Ratings

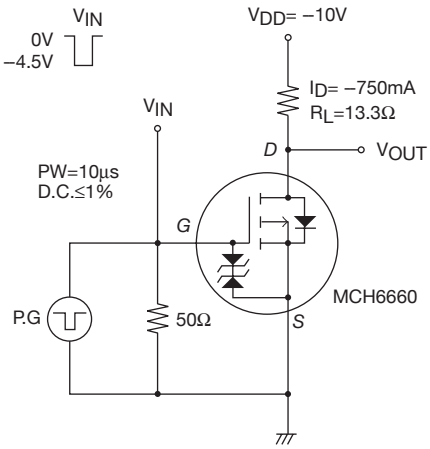
| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction to Ambient<br>When mounted on ceramic substrate (900mm$^2$×0.8mm) 1unit | $R_{\theta JA}$ | 156.3 | °C/W |

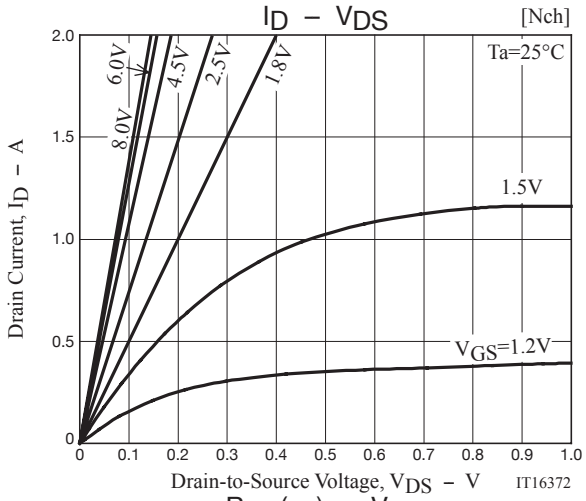
## Switching Time Test Circuit

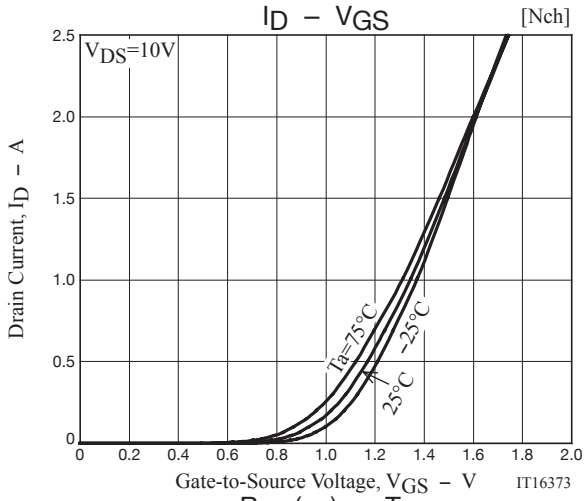
[N-channel]

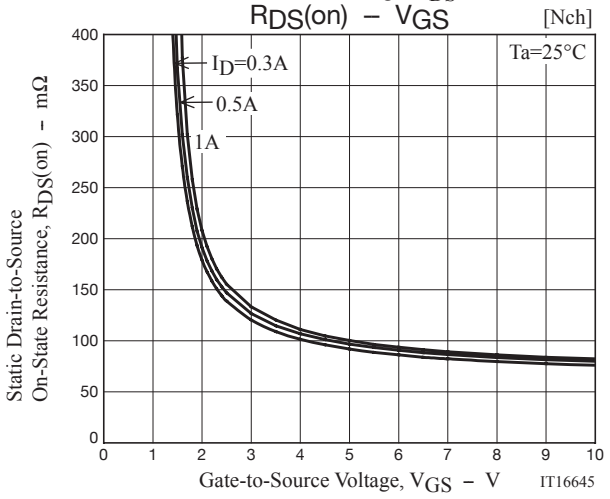


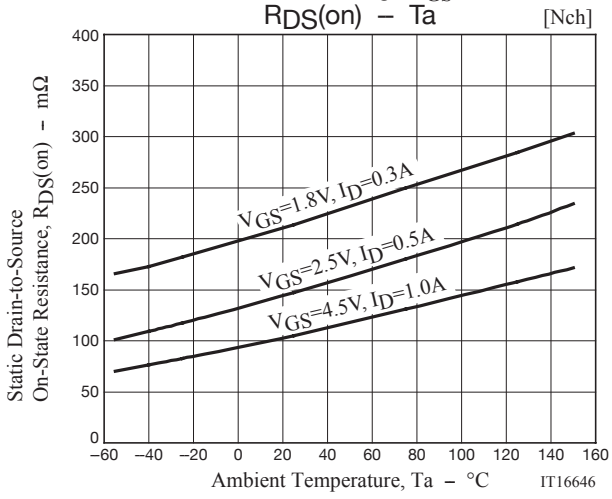

[P-channel]

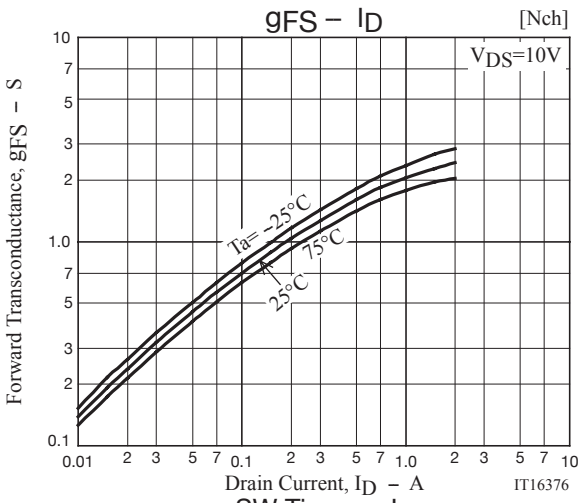


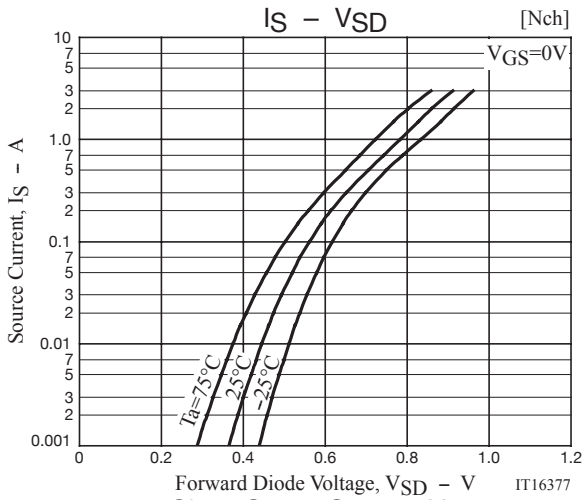



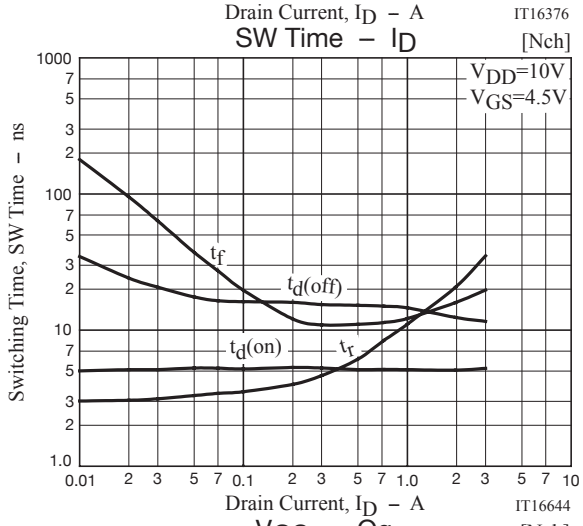



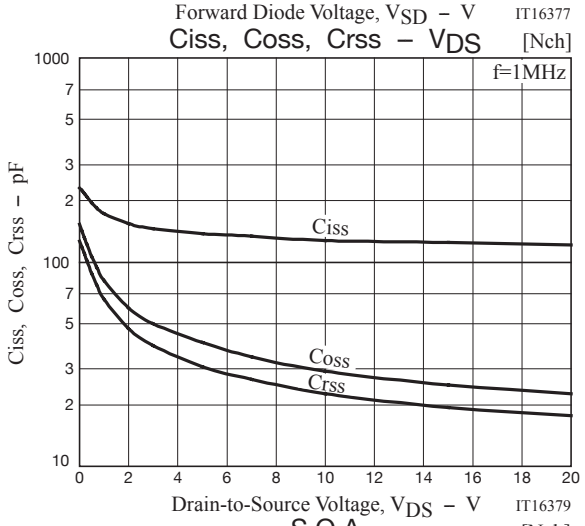



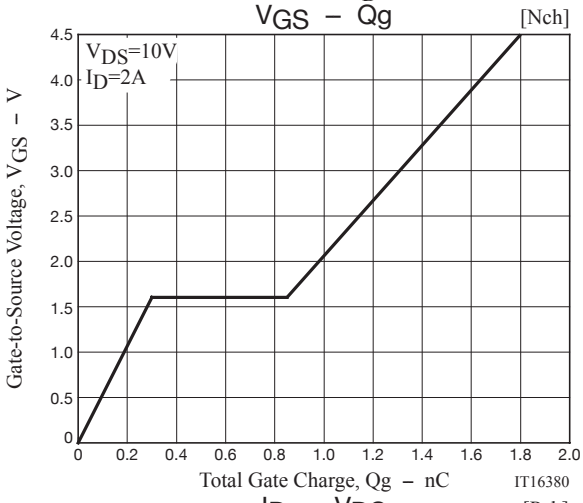



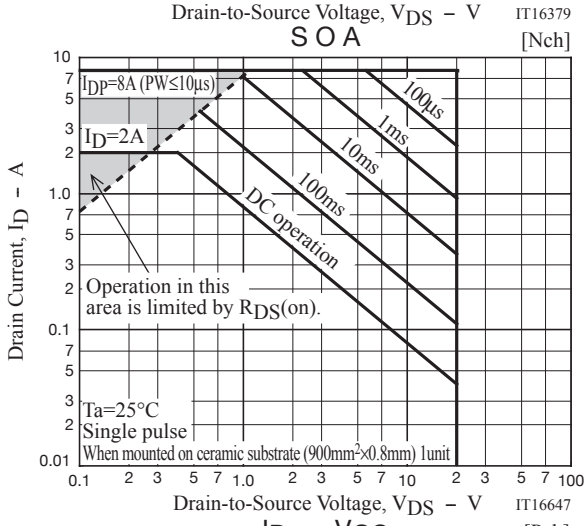

gFS – ID
[Nch]
VDS=10V
Ta= –25°C
75°C
25°C
Forward Transconductance, gFS – S
Drain Current, ID – A
IT16376

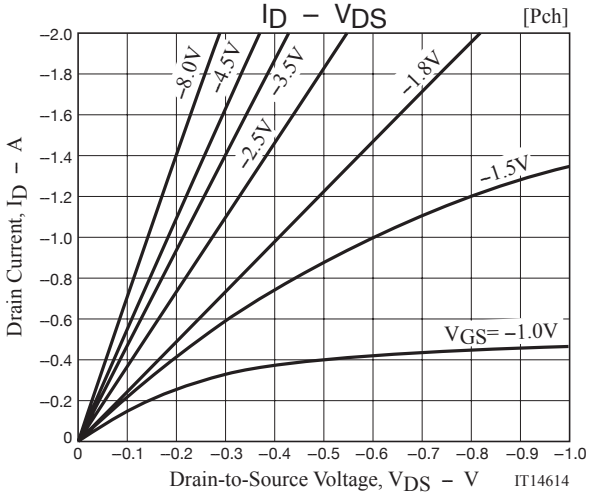

IS – VSD
[Nch]
VGS=0V
Ta=75°C
25°C
–25°C
Source Current, IS – A
Forward Diode Voltage, VSD – V
IT16377

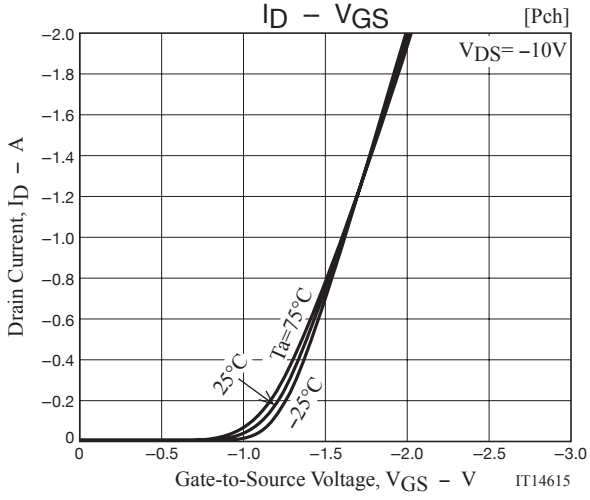

SW Time – ID
[Nch]
VDD=10V
VGS=4.5V
tf
td(off)
td(on)
tr
Switching Time, SW Time – ns
Drain Current, ID – A
IT16644

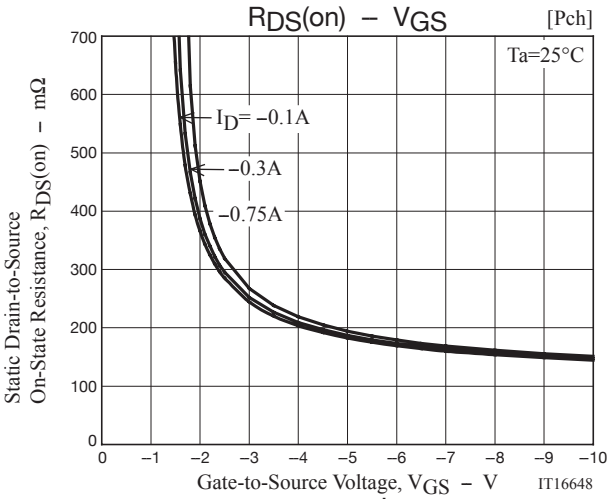

Ciss, Coss, Crss – VDS
[Nch]
f=1MHz
Ciss
Coss
Crss
Ciss, Coss, Crss – pF
Drain-to-Source Voltage, VDS – V
IT16379

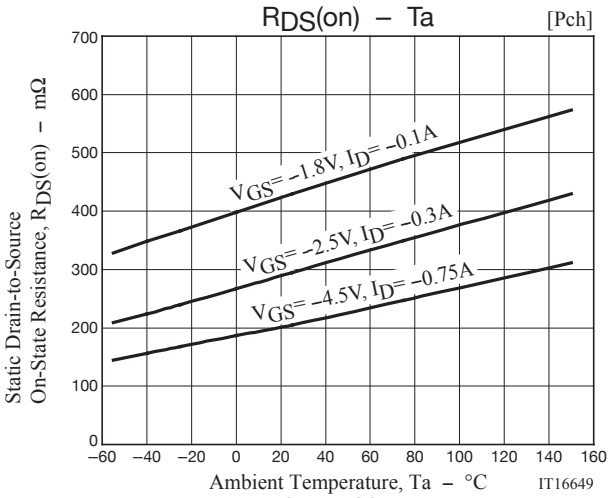

VGS – Qg
[Nch]
VDS=10V
ID=2A
Gate-to-Source Voltage, VGS – V
Total Gate Charge, Qg – nC
IT16380

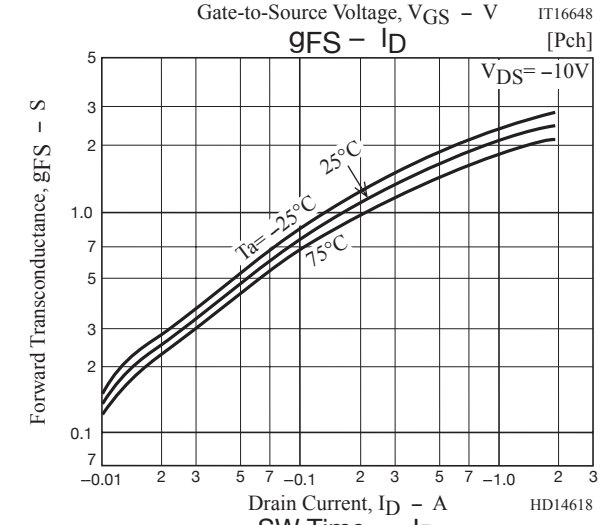

SOA
[Nch]
IDP=8A (PW≤10μs)
ID=2A
100μs
1ms
10ms
100ms
DC operation
Operation in this
area is limited by RDS(on).
Ta=25°C
Single pulse
When mounted on ceramic substrate (900mm2×0.8mm) 1unit
Drain Current, ID – A
Drain-to-Source Voltage, VDS – V
IT16647

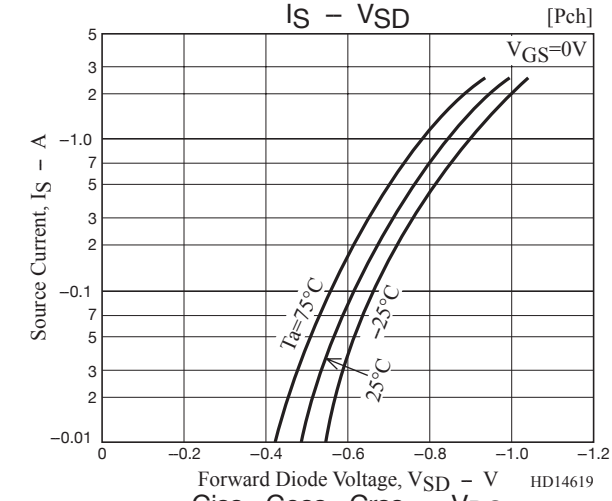

ID – VDS
[Pch]
–8.0V
–4.5V
–3.5V
–2.5V
–1.8V
–1.5V
VGS= –1.0V
Drain Current, ID – A
Drain-to-Source Voltage, VDS – V
IT14614

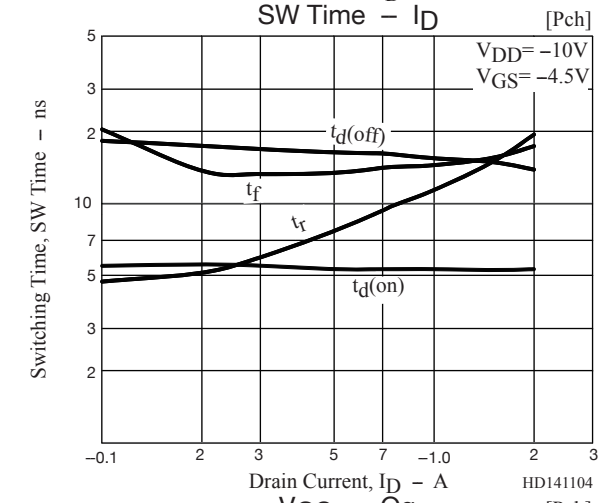

ID – VGS
[Pch]
VDS= –10V
25°C
Ta=75°C
–25°C
Drain Current, ID – A
Gate-to-Source Voltage, VGS – V
IT14615

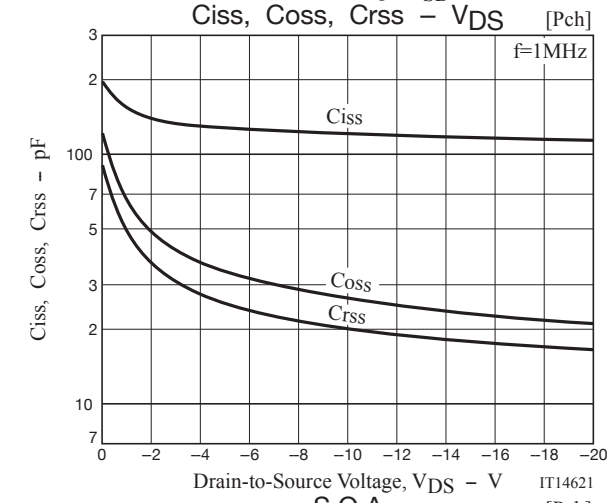

RDS(on) – VGS
[Pch]
Ta=25°C
ID= –0.1A
–0.3A
–0.75A
Static Drain-to-Source On-State Resistance, RDS(on) – mΩ
Gate-to-Source Voltage, VGS – V
IT16648

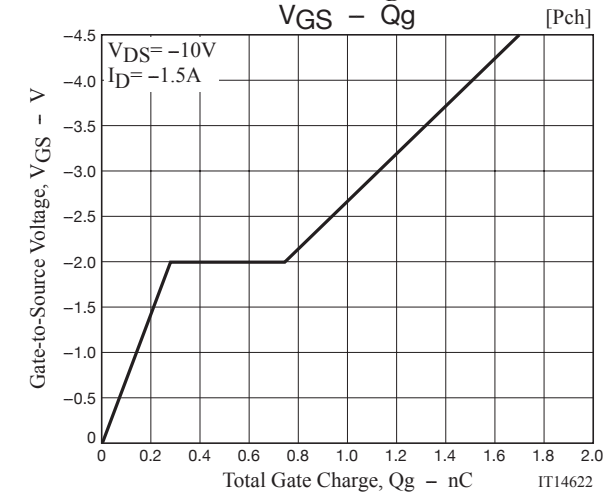

RDS(on) – Ta
[Pch]
VGS= –1.8V, ID= –0.1A
VGS= –2.5V, ID= –0.3A
VGS= –4.5V, ID= –0.75A
Static Drain-to-Source On-State Resistance, RDS(on) – mΩ
Ambient Temperature, Ta – °C
IT16649

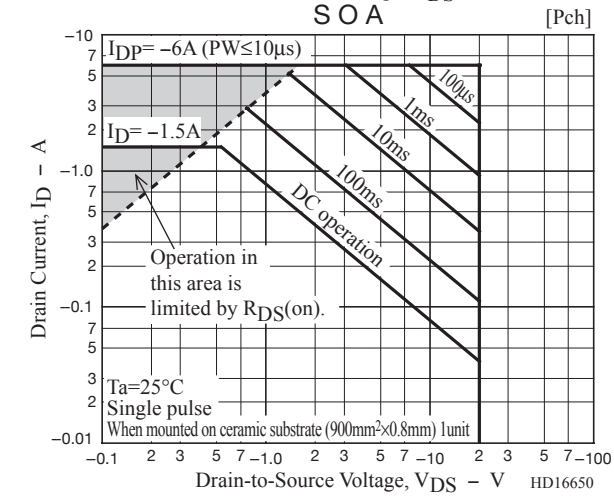

gFS – ID
[Pch]
VDS= –10V
25°C
Ta= –25°C
75°C
Forward Transconductance, gFS – S
Drain Current, ID – A
HD14618

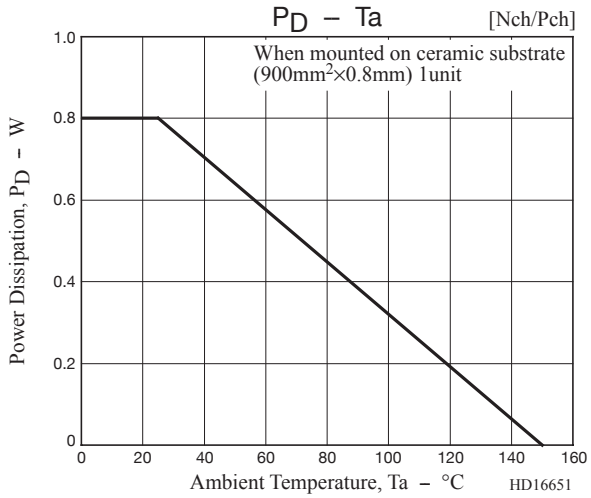

IS – VSD
[Pch]
VGS=0V
Ta=75°C
–25°C
25°C
Source Current, IS – A
Forward Diode Voltage, VSD – V
HD14619

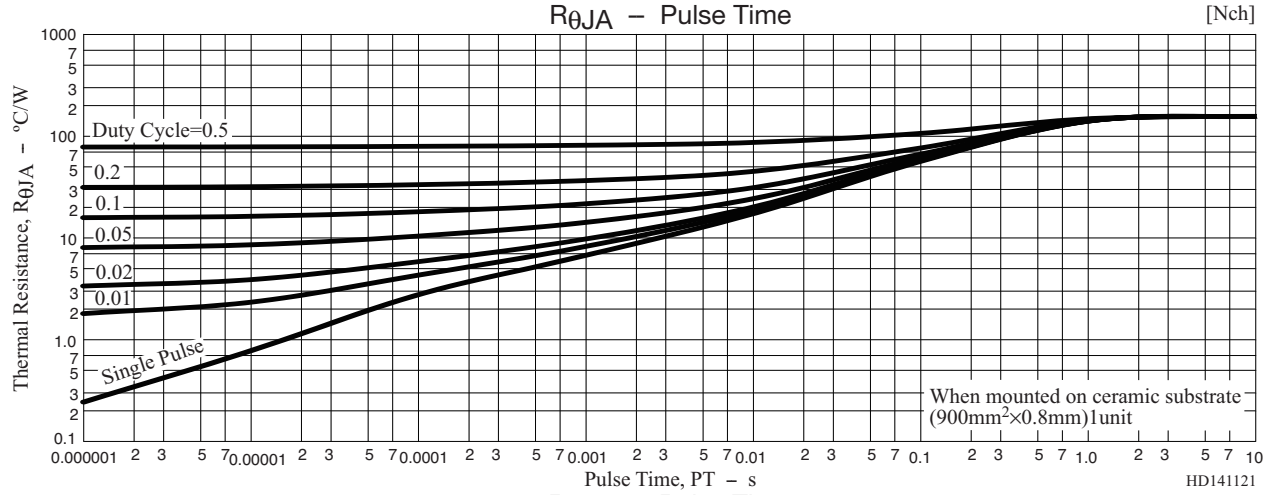

SW Time – ID
[Pch]
VDD= –10V
VGS= –4.5V
td(off)
tf
tr
td(on)
Switching Time, SW Time – ns
Drain Current, ID – A
HD141104

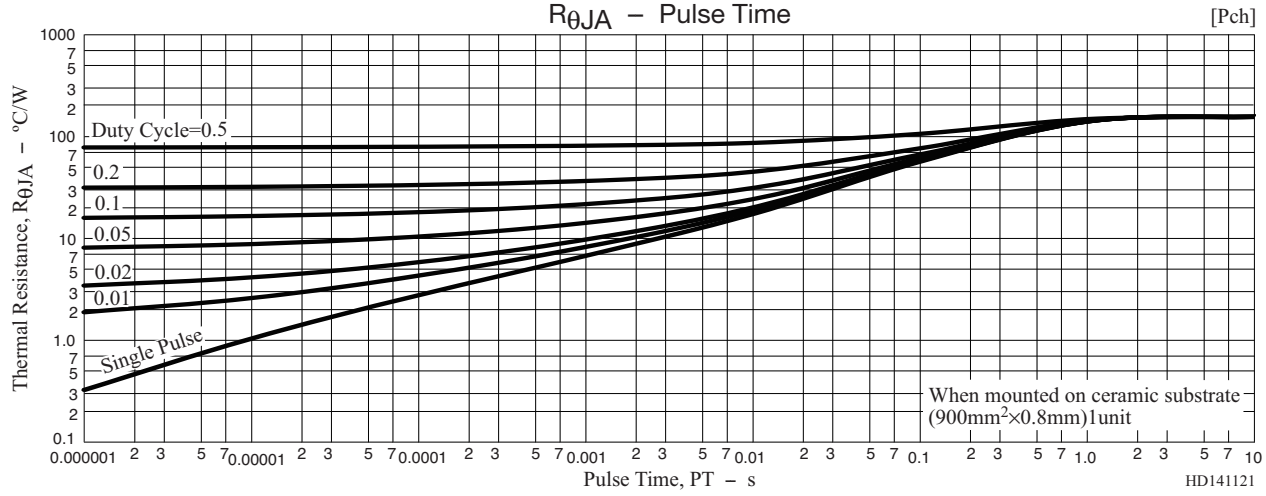

Ciss, Coss, Crss – VDS
[Pch]
f=1MHz
Ciss
Coss
Crss
Ciss, Coss, Crss – pF
Drain-to-Source Voltage, VDS – V
IT14621


VGS – Qg
[Pch]
VDS= –10V
ID= –1.5A
Gate-to-Source Voltage, VGS – V
Total Gate Charge, Qg – nC
IT14622


S O A
[Pch]
IDP= –6A (PW≤10μs)
ID= –1.5A
100μs
1ms
10ms
100ms
DC operation
Operation in this area is limited by RDS(on).
Ta=25°C
Single pulse
When mounted on ceramic substrate (900mm²×0.8mm) 1unit
Drain Current, ID – A
Drain-to-Source Voltage, VDS – V
HD16650


PD – Ta
[Nch/Pch]
When mounted on ceramic substrate
(900mm2×0.8mm) 1unit
Power Dissipation, PD – W
Ambient Temperature, Ta – °C
HD16651

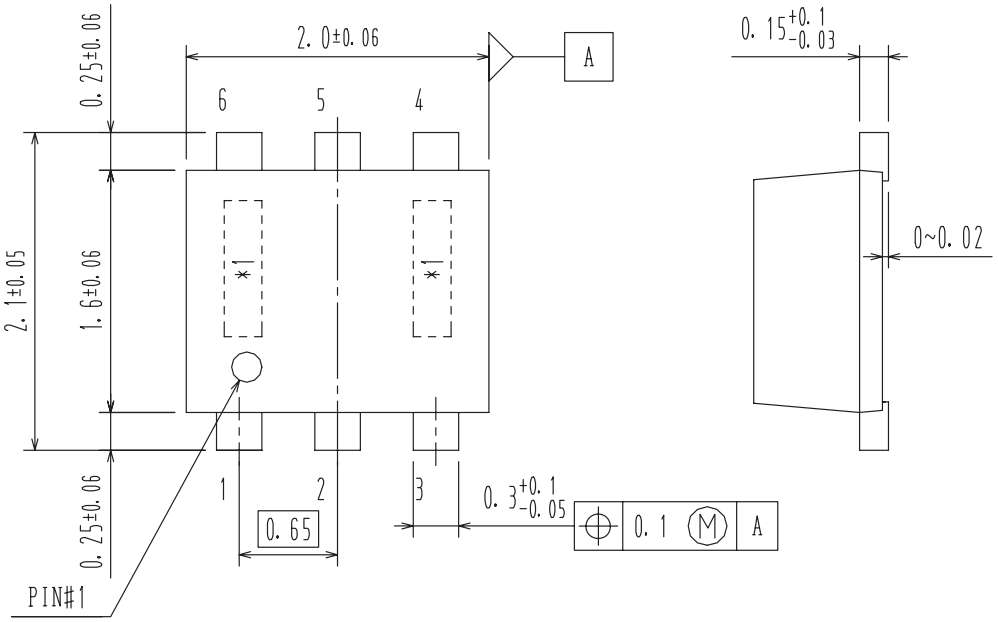

RθJA – Pulse Time
[Nch]
Duty Cycle=0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
When mounted on ceramic substrate
(900mm2×0.8mm)1unit
Thermal Resistance, RθJA – °C/W
Pulse Time, PT – s
HD141121

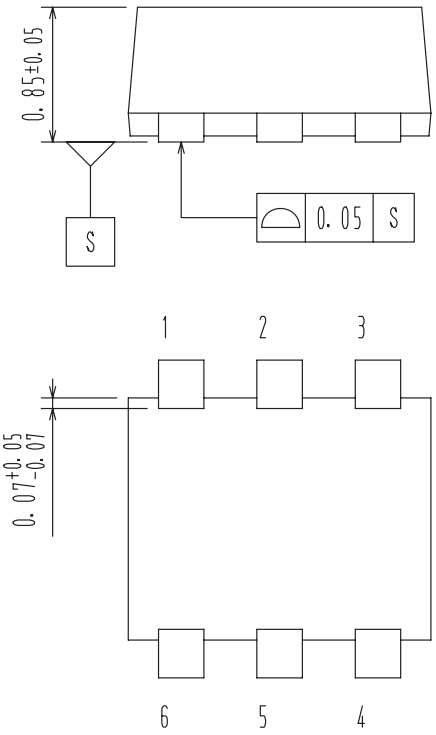

RθJA – Pulse Time
[Pch]
Duty Cycle=0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
When mounted on ceramic substrate
(900mm2×0.8mm)1unit
Thermal Resistance, RθJA – °C/W
Pulse Time, PT – s
HD141121

**Paclage Dimensions**
unit : mm

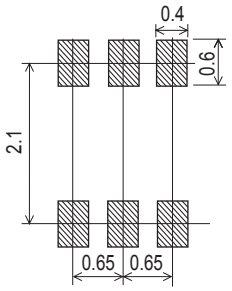
MCH6660-TL-H, MCH6660-TL-W

**SC-88FL / MCPH6**
CASE 419AS
ISSUE O




**Recommended Soldering Footprint**




*1:Lot indication

## ORDERING INFORMATION

| Device | Package | Shipping | memo |
|---|---|---|---|
| MCH6660-TL-H | MCPH6 | 3,000pcs./reel | Pb-Free and Halogen Free |
| MCH6660-TL-W | | | |

Note on usage : Since the MCH6660 is a MOSFET product, please avoid using this device in the vicinity of highly charged objects.