Ordering number : ENA0934

SANYO Semiconductors

DATA SHEET

N-Channel and P-Channel Silicon MOSFETs

# VEC2603 — General-Purpose Switching Device Applications

## Features

- A composite type of a low on-resistance P-channel MOSFET and a small signal N-channel MOSFET for driving P-channel MOSFET enables high-density mounting.
- Best suited for load switches.
- 1.8V drive.
- 0.75mm mount high.

## Specifications

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

| Parameter | Symbol | Conditions | N-channel | P-channel | Unit |
|---|---|---|---|---|---|
| Drain-to-Source Voltage | $V_{DSS}$ | | 30 | −12 | V |
| Gate-to-Source Voltage | $V_{GSS}$ | | ±10 | ±8 | V |
| Drain Current (DC) | $I_D$ | | 0.15 | −4 | A |
| Drain Current (Pulse) | $I_{DP}$ | PW≤10μs, duty cycle≤1% | 0.6 | −16 | A |
| Allowable Power Dissipation | $P_D$ | Mounted on a ceramic board (900mm²X0.8mm)1unit | 0.9 | | W |
| Channel Temperature | Tch | | 150 | | °C |
| Storage Temperature | Tstg | | −55 to +150 | | °C |

### Electrical Characteristics at Ta=25°C

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| [N-channel] | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D$=1mA, $V_{GS}$=0V | 30 | | | V |
| Zero-Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=30V, $V_{GS}$=0V | | | 1 | μA |
| Gate-to-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±8V, $V_{DS}$=0V | | | ±10 | μA |
| Cutoff Voltage | $V_{GS}$(off) | $V_{DS}$=10V, $I_D$=100μA | 0.4 | | 1.3 | V |
| Forward Transfer Admittance | $\|yfs\|$ | $V_{DS}$=10V, $I_D$=80mA | 0.15 | 0.22 | | S |

Marking : BF

Continued on next page.

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SANYO Semiconductor Co., Ltd.
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

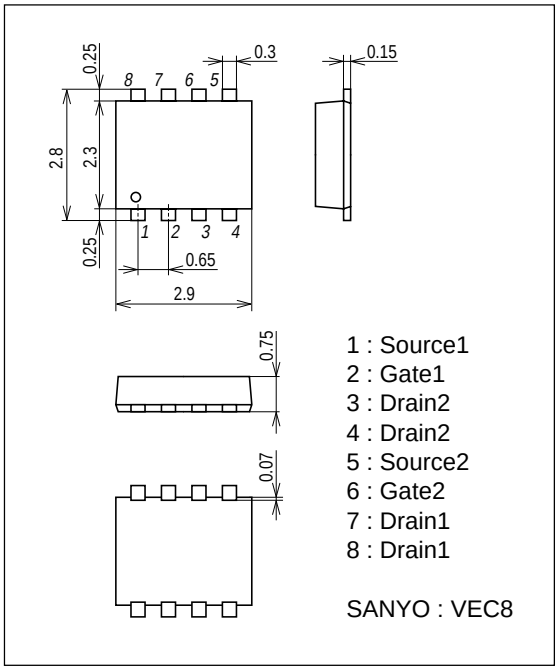
Continued from preceding page.

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Static Drain-to-Source On-State Resistance | $R_{DS}(on)1$ | $I_D$=80mA, $V_{GS}$=4V | | 2.9 | 3.7 | Ω |
| | $R_{DS}(on)2$ | $I_D$=40mA, $V_{GS}$=2.5V | | 3.7 | 5.2 | Ω |
| | $R_{DS}(on)3$ | $I_D$=10mA, $V_{GS}$=1.5V | | 6.4 | 12.8 | Ω |
| Input Capacitance | Ciss | $V_{DS}$=10V, f=1MHz | | 7.0 | | pF |
| Output Capacitance | Coss | $V_{DS}$=10V, f=1MHz | | 5.9 | | pF |
| Reverse Transfer Capacitance | Crss | $V_{DS}$=10V, f=1MHz | | 2.3 | | pF |
| Turn-ON Delay Time | $t_d(on)$ | See specified Test Circuit. | | 19 | | ns |
| Rise Time | $t_r$ | See specified Test Circuit. | | 65 | | ns |
| Turn-OFF Delay Time | $t_d(off)$ | See specified Test Circuit. | | 155 | | ns |
| Fall Time | $t_f$ | See specified Test Circuit. | | 120 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=150mA | | 1.58 | | nC |
| Gate-to-Source Charge | Qgs | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=150mA | | 0.26 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=150mA | | 0.31 | | nC |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=150mA, $V_{GS}$=0V | | 0.87 | 1.2 | V |
| [P-channel] | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D$=−1mA, $V_{GS}$=0V | −12 | | | V |
| Zero-Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=−12V, $V_{GS}$=0V | | | −10 | μA |
| Gate-to-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±6.4V, $V_{DS}$=0V | | | ±10 | μA |
| Cutoff Voltage | $V_{GS}(off)$ | $V_{DS}$=−6V, $I_D$=−1mA | −0.3 | | −1.0 | V |
| Forward Transfer Admittance | $\|yfs\|$ | $V_{DS}$=−6V, $I_D$=−2A | 4.5 | 7.6 | | S |
| Static Drain-to-Source On-State Resistance | $R_{DS}(on)1$ | $I_D$=−2A, $V_{GS}$=−4.5V | | 40 | 53 | mΩ |
| | $R_{DS}(on)2$ | $I_D$=−1A, $V_{GS}$=−2.5V | | 57 | 80 | mΩ |
| | $R_{DS}(on)3$ | $I_D$=−0.3A, $V_{GS}$=−1.8V | | 78 | 112 | mΩ |
| Input Capacitance | Ciss | $V_{DS}$=−6V, f=1MHz | | 940 | | pF |
| Output Capacitance | Coss | $V_{DS}$=−6V, f=1MHz | | 230 | | pF |
| Reverse Transfer Capacitance | Crss | $V_{DS}$=−6V, f=1MHz | | 180 | | pF |
| Turn-ON Delay Time | $t_d(on)$ | See specified Test Circuit. | | 14 | | ns |
| Rise Time | $t_r$ | See specified Test Circuit. | | 120 | | ns |
| Turn-OFF Delay Time | $t_d(off)$ | See specified Test Circuit. | | 97 | | ns |
| Fall Time | $t_f$ | See specified Test Circuit. | | 110 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=−6V, $V_{GS}$=−4.5V, $I_D$=−4A | | 11 | | nC |
| Gate-to-Source Charge | Qgs | $V_{DS}$=−6V, $V_{GS}$=−4.5V, $I_D$=−4A | | 1.6 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | $V_{DS}$=−6V, $V_{GS}$=−4.5V, $I_D$=−4A | | 2.8 | | nC |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=−4A, $V_{GS}$=0V | | −0.85 | −1.5 | V |

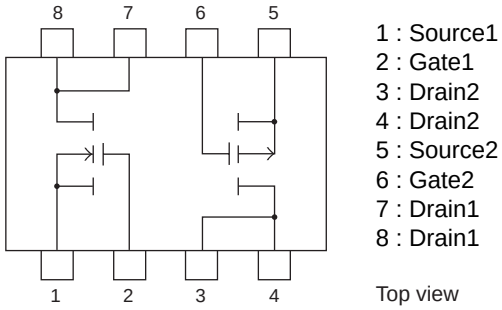
## Package Dimensions

unit : mm (typ)

7012-009

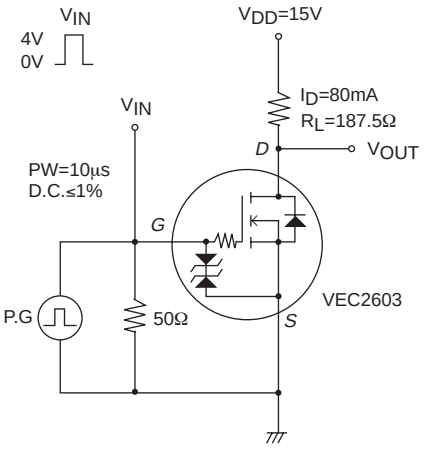



## Electrical Connection

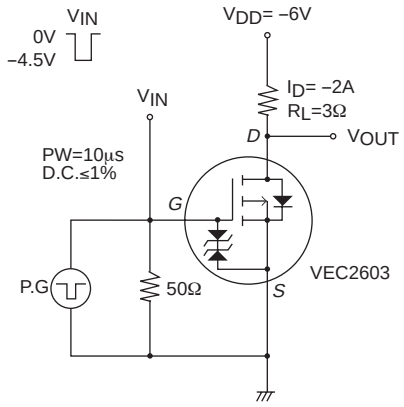


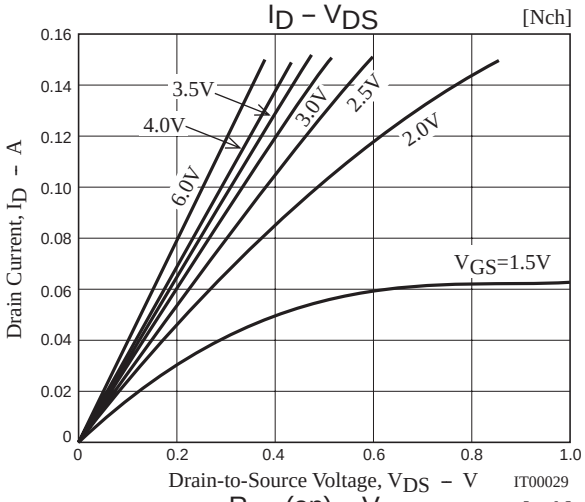
## Switching Time Test Circuit

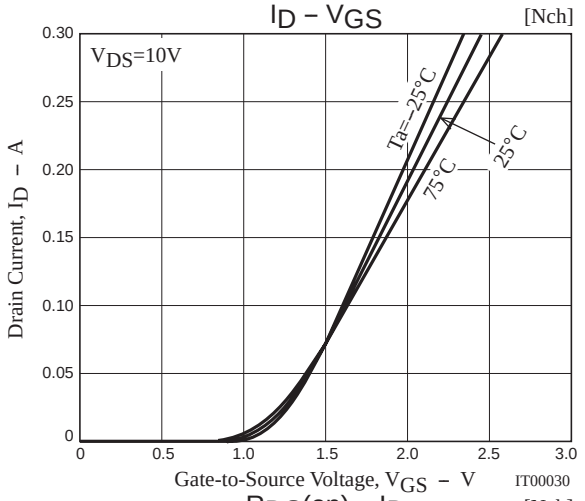
[N-channel]

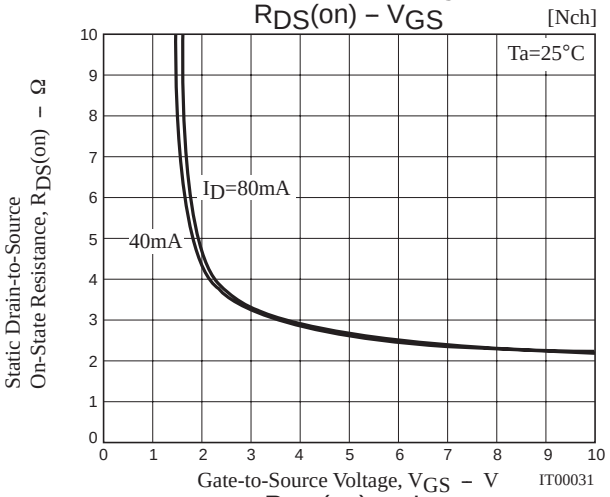


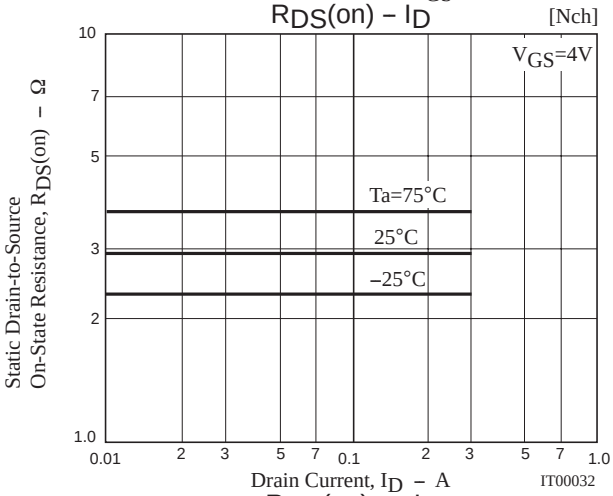

[P-channel]

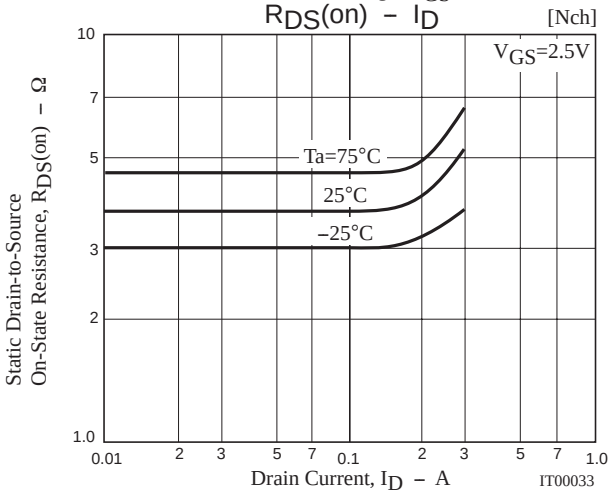


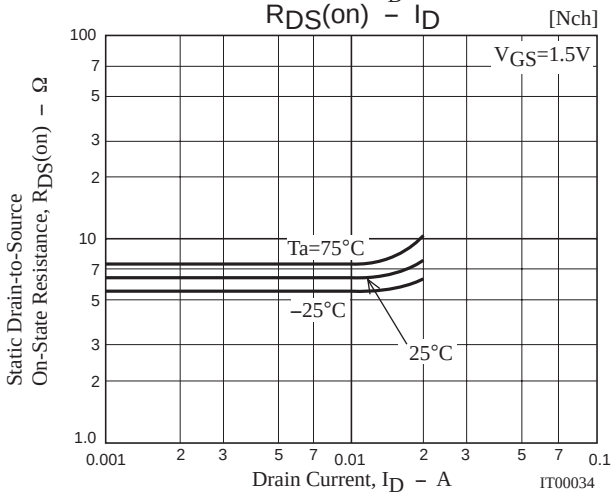



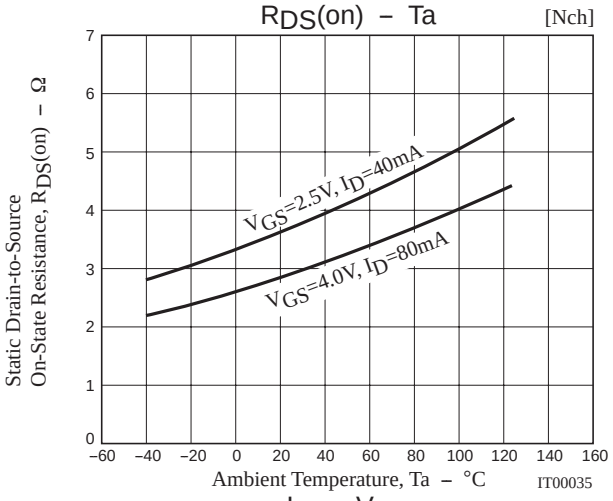



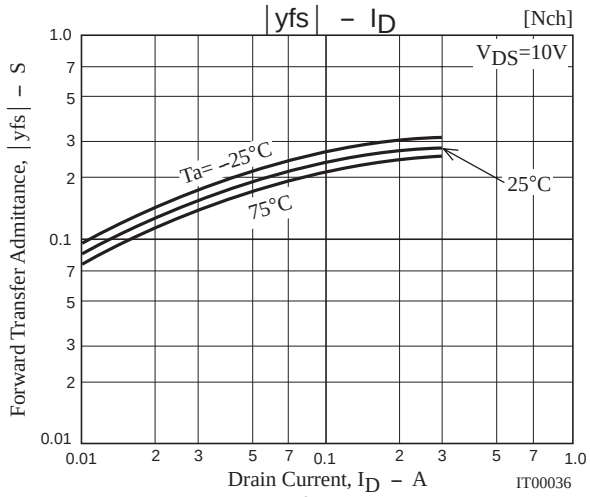



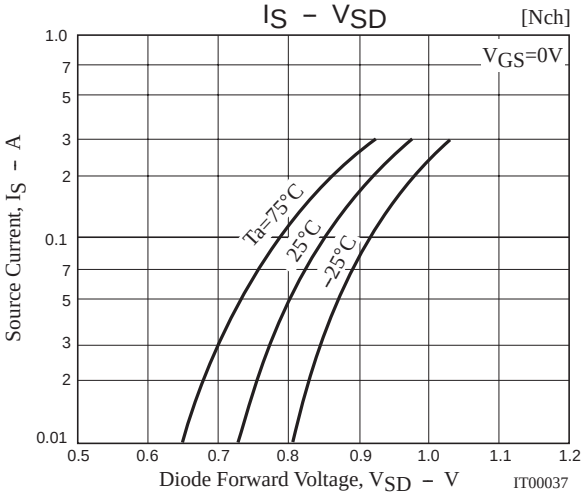



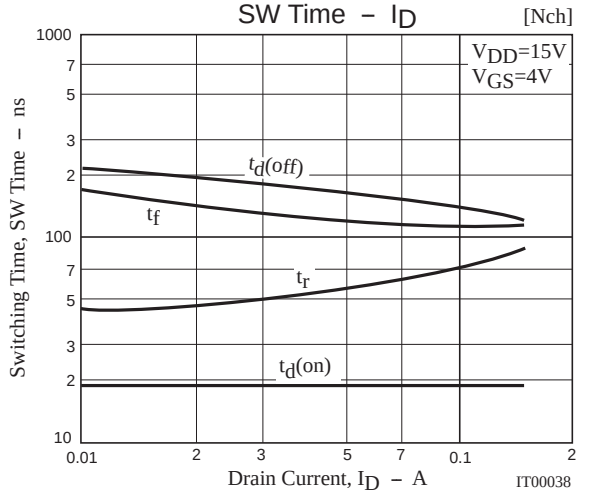



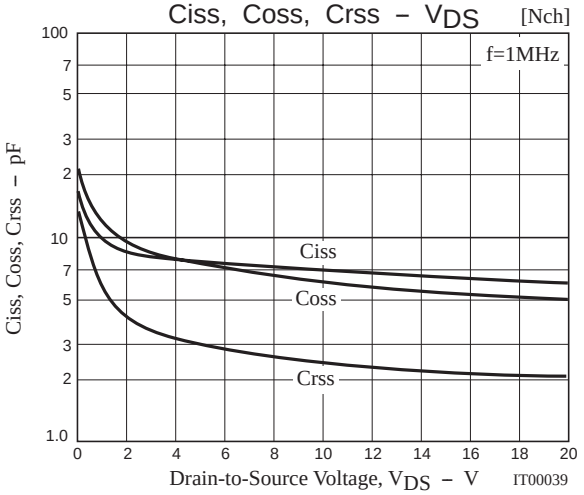



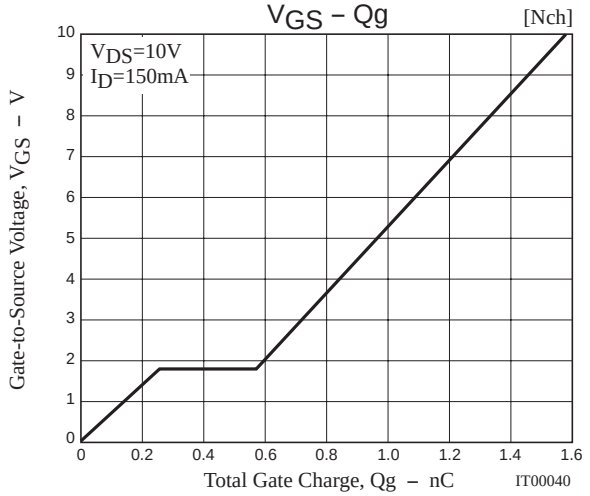

RDS(on) – Ta
[Nch]
Static Drain-to-Source On-State Resistance, RDS(on) – Ω
VGS=2.5V, ID=40mA
VGS=4.0V, ID=80mA
Ambient Temperature, Ta – °C
IT00035

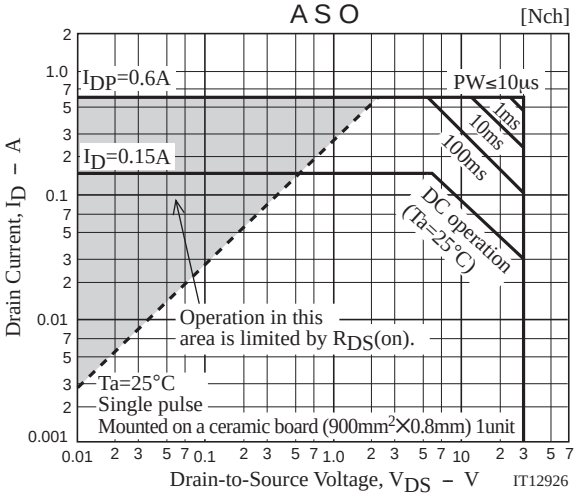

|yfs| – ID
[Nch]
VDS=10V
Ta= –25°C
75°C
25°C
Forward Transfer Admittance, |yfs| – S
Drain Current, ID – A
IT00036

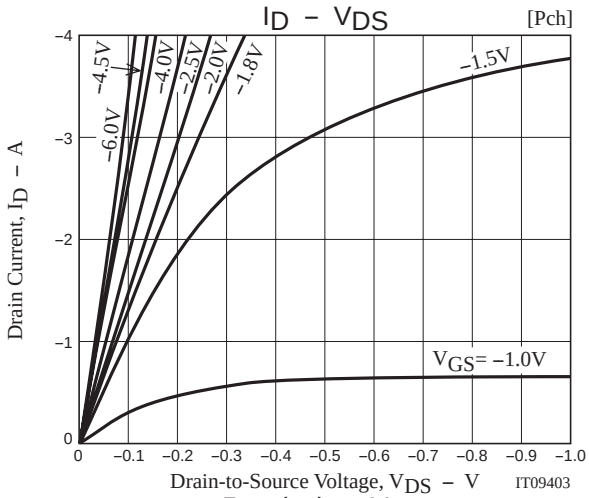

IS – VSD
[Nch]
VGS=0V
Ta=75°C
25°C
–25°C
Source Current, IS – A
Diode Forward Voltage, VSD – V
IT00037

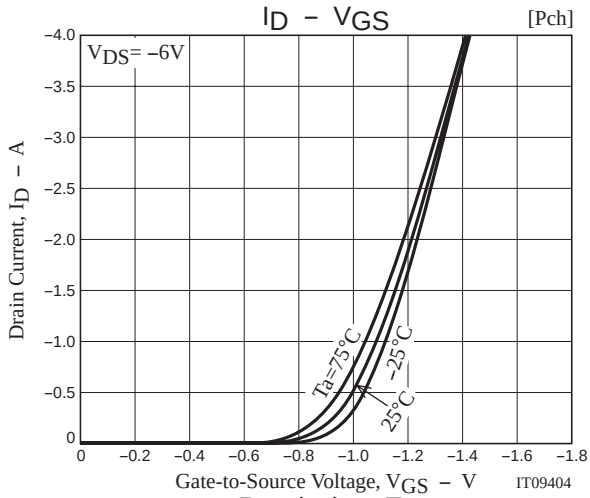

SW Time – ID
[Nch]
VDD=15V
VGS=4V
td(off)
tf
tr
td(on)
Switching Time, SW Time – ns
Drain Current, ID – A
IT00038

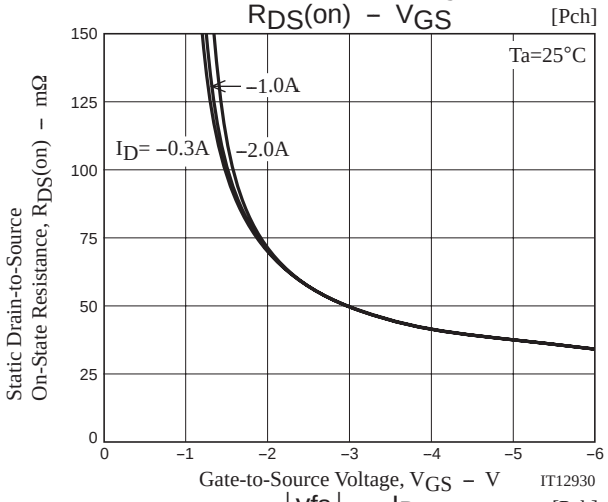

Ciss, Coss, Crss – VDS
[Nch]
f=1MHz
Ciss
Coss
Crss
Ciss, Coss, Crss – pF
Drain-to-Source Voltage, VDS – V
IT00039

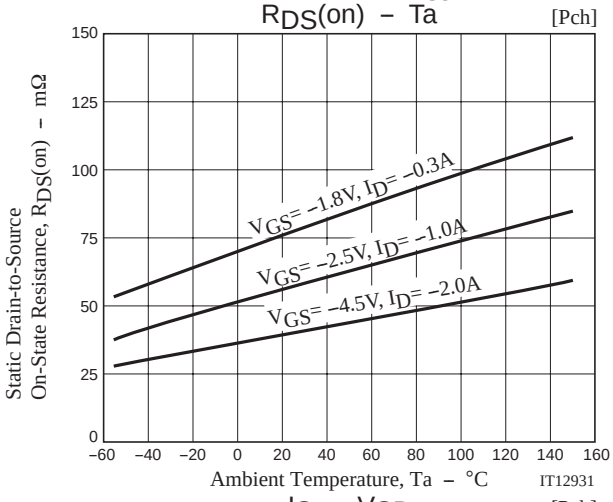

VGS – Qg
[Nch]
VDS=10V
ID=150mA
Gate-to-Source Voltage, VGS – V
Total Gate Charge, Qg – nC
IT00040

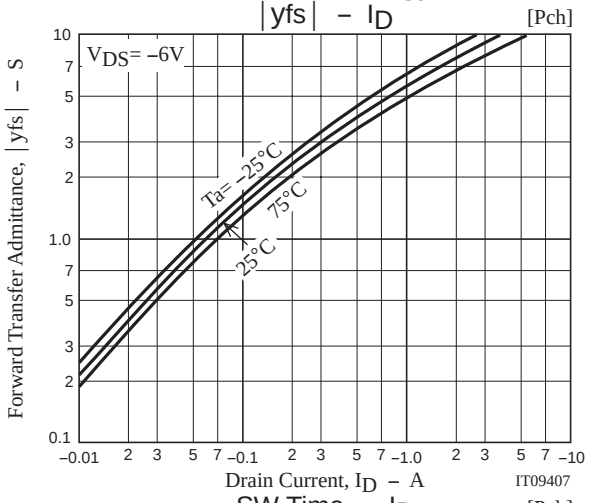

A S O
[Nch]
IDP=0.6A
PW≤10μs
1ms
10ms
100ms
DC operation (Ta=25°C)
ID=0.15A
Operation in this area is limited by RDS(on).
Ta=25°C
Single pulse
Mounted on a ceramic board (900mm2×0.8mm) 1unit
Drain Current, ID – A
Drain-to-Source Voltage, VDS – V
IT12926

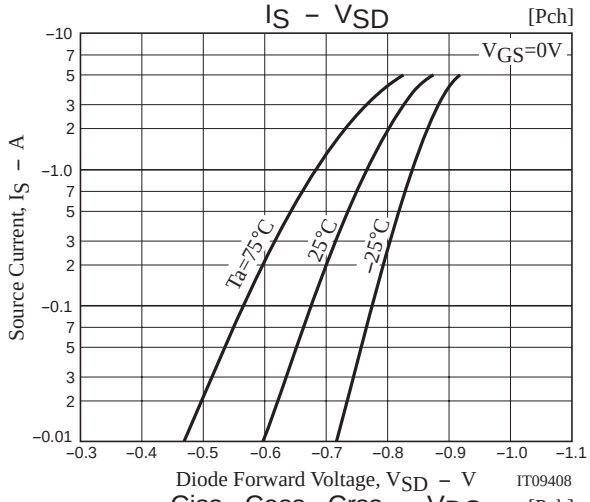

ID – VDS
[Pch]
Drain Current, ID – A
Drain-to-Source Voltage, VDS – V
IT09403
–4.5V
–6.0V
–4.0V
–2.5V
–2.0V
–1.8V
–1.5V
VGS= –1.0V

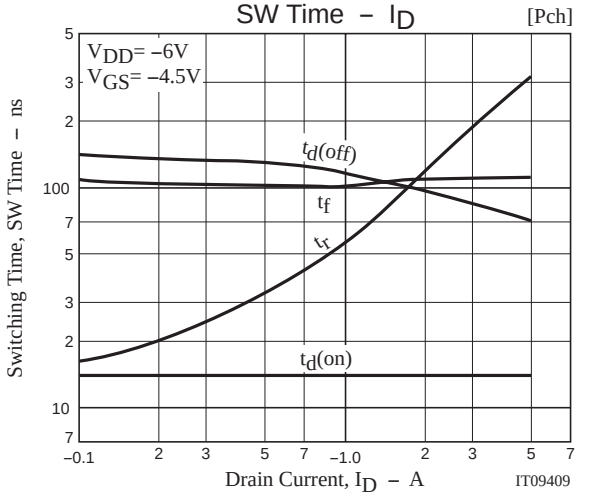

ID – VGS
[Pch]
Drain Current, ID – A
Gate-to-Source Voltage, VGS – V
IT09404
VDS= –6V
Ta=75°C
–25°C
25°C

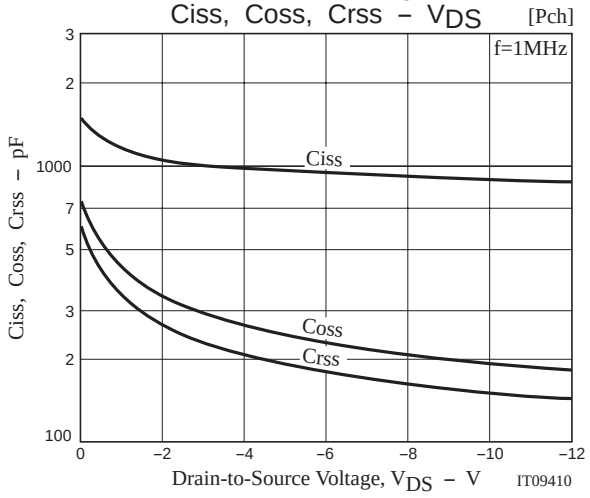

RDS(on) – VGS
[Pch]
Static Drain-to-Source On-State Resistance, RDS(on) – mΩ
Gate-to-Source Voltage, VGS – V
IT12930
Ta=25°C
–1.0A
ID= –0.3A
–2.0A

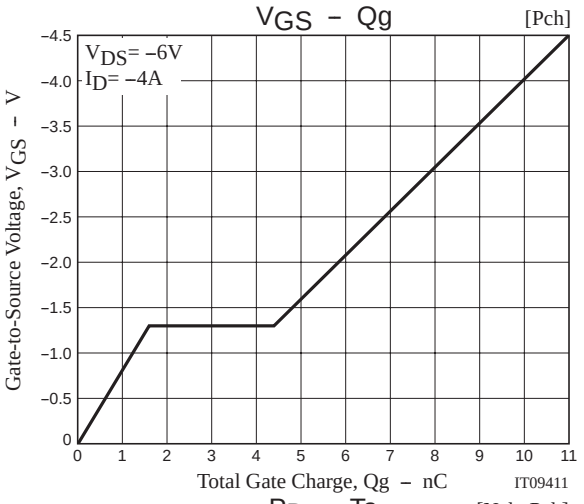

RDS(on) – Ta
[Pch]
Static Drain-to-Source On-State Resistance, RDS(on) – mΩ
Ambient Temperature, Ta – °C
IT12931
VGS= –1.8V, ID= –0.3A
VGS= –2.5V, ID= –1.0A
VGS= –4.5V, ID= –2.0A

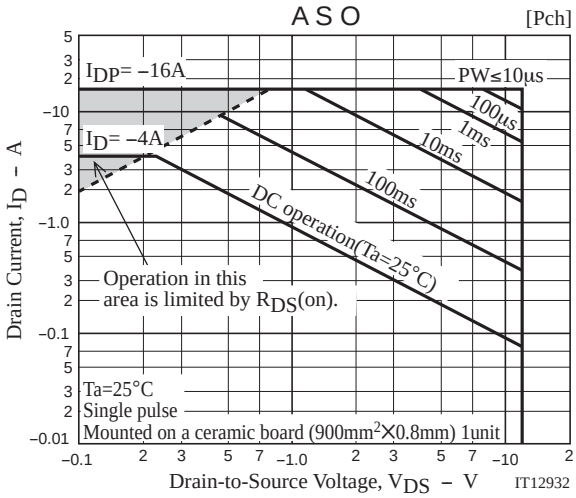

|yfs| – ID
[Pch]
Forward Transfer Admittance, |yfs| – S
Drain Current, ID – A
IT09407
VDS= –6V
Ta= –25°C
75°C
25°C

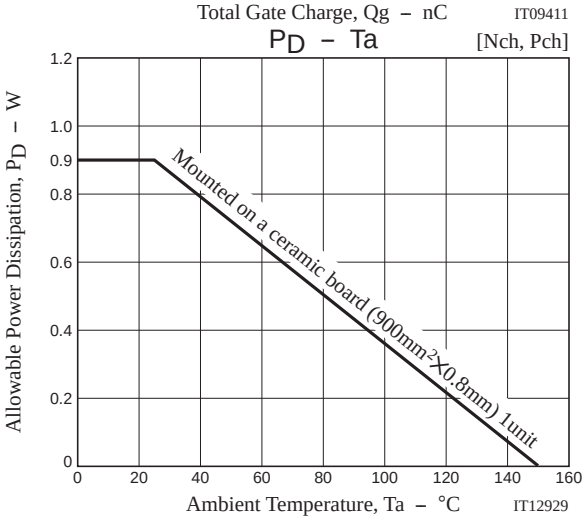

IS – VSD
[Pch]
Source Current, IS – A
Diode Forward Voltage, VSD – V
IT09408
VGS=0V
Ta=75°C
25°C
–25°C


SW Time – ID
[Pch]
Switching Time, SW Time – ns
Drain Current, ID – A
IT09409
VDD= –6V
VGS= –4.5V
td(off)
tf
tr
td(on)


Ciss, Coss, Crss – VDS
[Pch]
Ciss, Coss, Crss – pF
Drain-to-Source Voltage, VDS – V
IT09410
f=1MHz
Ciss
Coss
Crss




Note on usage : Since the VEC2603 is a MOSFET product, please avoid using this device in the vicinity of highly charged objects.


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