Ordering number : ENA0103

SANYO Semiconductors
DATA SHEET

N-Channel and P-Channel Silicon MOSFETs

# VEC2609 — General-Purpose Switching Device Applications

## Features

- The best suited for inverter applications.
- The VEC2609 incorporates an N-channel MOSFET and a P-channel MOSFET that feature low ON-resistance, thereby enabling high-density mounting.
- Low voltage drive.
- Mounting height 0.75mm.

## 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 | $V_{GSS}$ | | ±20 | ±8 | V |
| Drain Current (DC) | $I_D$ | | 1.4 | −2 | A |
| Drain Current (Pulse) | $I_{DP}$ | PW≤10μs, duty cycle≤1% | 5.6 | −8 | A |
| Allowable Power Dissipation | $P_D$ | Mounted on a ceramic board (900mm²X0.8mm)1unit | 0.8 | | W |
| Total Dissipation | $P_T$ | Mounted on a ceramic board (900mm²X0.8mm) | 1.0 | | 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 | $I_{GSS}$ | $V_{GS}$=±16V, $V_{DS}$=0V | | | ±10 | μA |
| Cutoff Voltage | $V_{GS}$(off) | $V_{DS}$=10V, $I_D$=1mA | 1.2 | | 2.6 | V |
| Forward Transfer Admittance | \|yfs\| | $V_{DS}$=10V, $I_D$=700mA | 0.66 | 1.1 | | S |
| Static Drain-to-Source On-State Resistance | $R_{DS}$(on)1 | $I_D$=700mA, $V_{GS}$=10V | | 230 | 300 | mΩ |
| | $R_{DS}$(on)2 | $I_D$=400mA, $V_{GS}$=4V | | 400 | 560 | mΩ |
| Input Capacitance | Ciss | $V_{DS}$=10V, f=1MHz | | 65 | | pF |
| Output Capacitance | Coss | $V_{DS}$=10V, f=1MHz | | 14 | | pF |
| Reverse Transfer Capacitance | Crss | $V_{DS}$=10V, f=1MHz | | 8 | | pF |

Marking : CF

Continued on next page.




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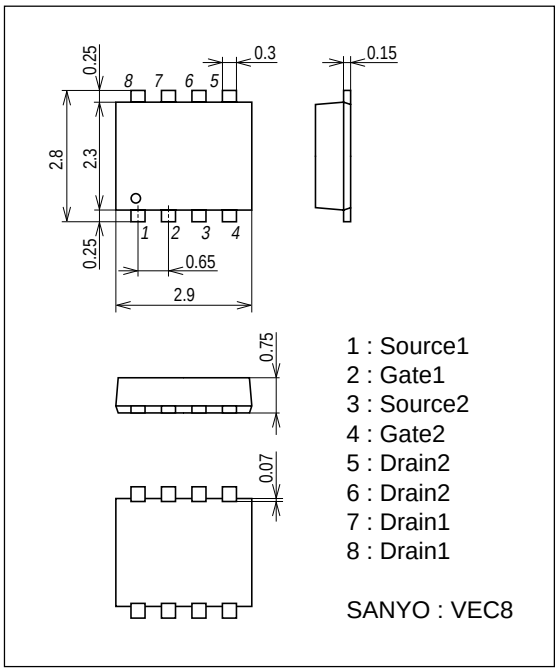
Continued from preceding page.

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Turn-ON Delay Time | $t_{d(on)}$ | See specified Test Circuit. | | 5 | | ns |
| Rise Time | $t_r$ | See specified Test Circuit. | | 4 | | ns |
| Turn-OFF Delay Time | $t_{d(off)}$ | See specified Test Circuit. | | 11 | | ns |
| Fall Time | $t_f$ | See specified Test Circuit. | | 3 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=1.4A | | 2.5 | | nC |
| Gate-to-Source Charge | Qgs | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=1.4A | | 0.6 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=1.4A | | 0.3 | | nC |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=1.4A, $V_{GS}$=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, $I_D$=–1.5A | 2.7 | 4.5 | | S |
| Static Drain-to-Source On-State Resistance | $R_{DS(on)1}$ | $I_D$=–1.5A, $V_{GS}$=–4.5V | | 87 | 115 | mΩ |
| | $R_{DS(on)2}$ | $I_D$=–0.8A, $V_{GS}$=–2.5V | | 122 | 172 | mΩ |
| | $R_{DS(on)3}$ | $I_D$=–0.4A, $V_{GS}$=–1.8V | | 162 | 275 | mΩ |
| Input Capacitance | Ciss | $V_{DS}$=–6V, f=1MHz | | 450 | | pF |
| Output Capacitance | Coss | $V_{DS}$=–6V, f=1MHz | | 100 | | pF |
| Reverse Transfer Capacitance | Crss | $V_{DS}$=–6V, f=1MHz | | 85 | | pF |
| Turn-ON Delay Time | $t_{d(on)}$ | See specified Test Circuit. | | 15 | | ns |
| Rise Time | $t_r$ | See specified Test Circuit. | | 75 | | ns |
| Turn-OFF Delay Time | $t_{d(off)}$ | See specified Test Circuit. | | 64 | | ns |
| Fall Time | $t_f$ | See specified Test Circuit. | | 50 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=–6V, $V_{GS}$=–4.5V, $I_D$=–2.5A | | 6.5 | | nC |
| Gate-to-Source Charge | Qgs | $V_{DS}$=–6V, $V_{GS}$=–4.5V, $I_D$=–2.5A | | 0.8 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | $V_{DS}$=–6V, $V_{GS}$=–4.5V, $I_D$=–2.5A | | 2.0 | | nC |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=–2.5A, $V_{GS}$=0V | | –0.85 | –1.5 | V |

## Package Dimensions

unit : mm

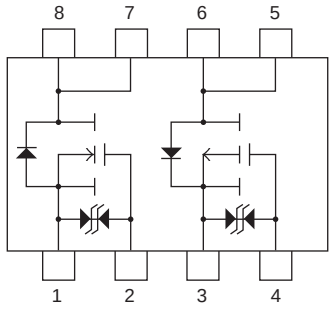
7012-002




1 : Source1
2 : Gate1
3 : Source2
4 : Gate2
5 : Drain2
6 : Drain2
7 : Drain1
8 : Drain1

SANYO : VEC8

## Electrical Connection

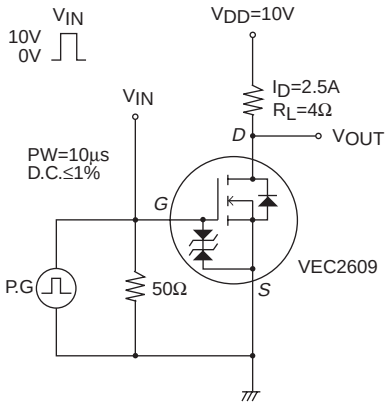



1 : Source1
2 : Gate1
3 : Source2
4 : Gate2
5 : Drain2
6 : Drain2
7 : Drain1
8 : Drain1

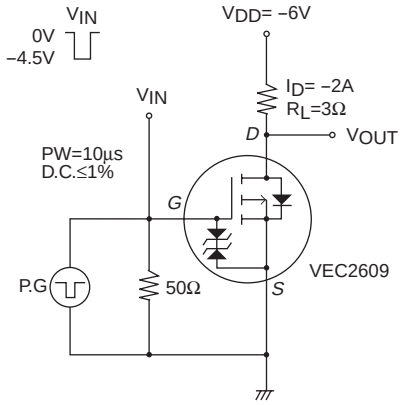
Top view

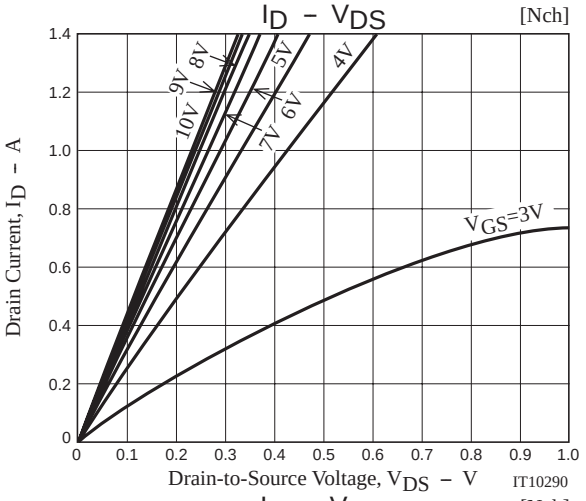
## Switching Time Test Circuit

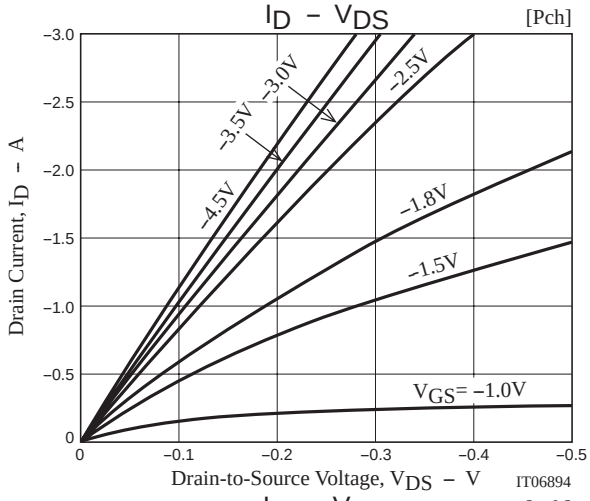
[N-channel]

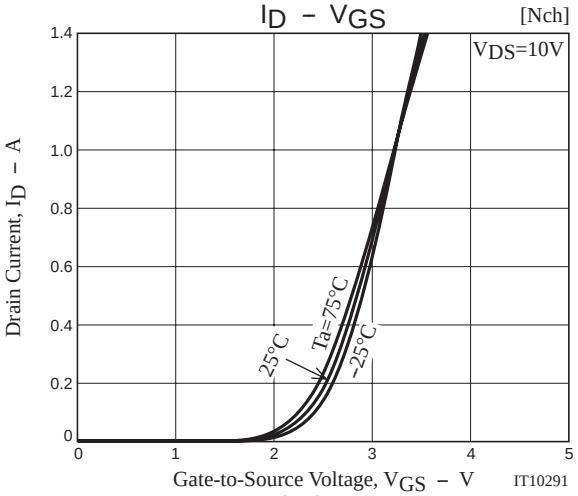


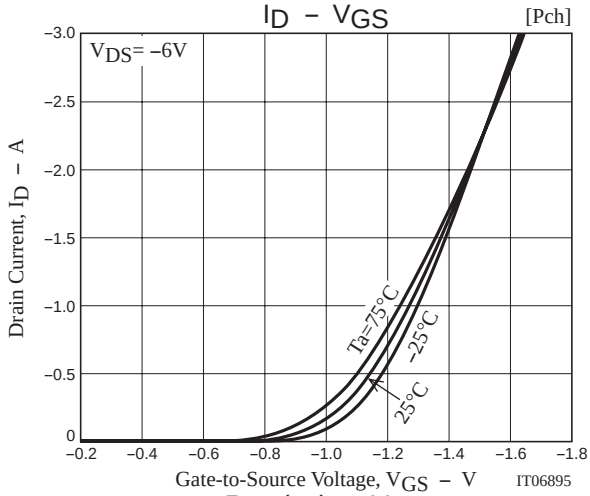

[P-channel]

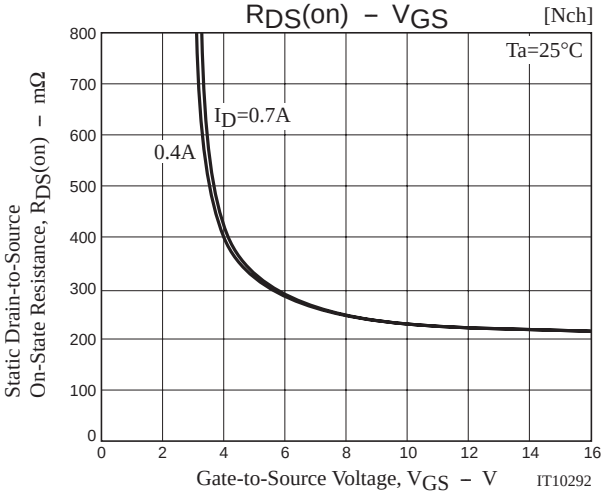


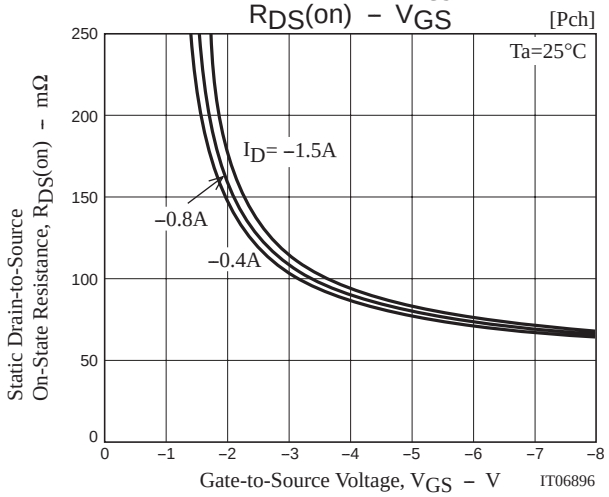



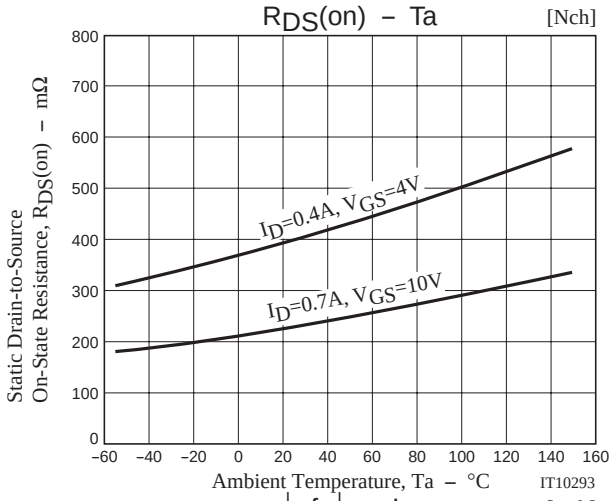



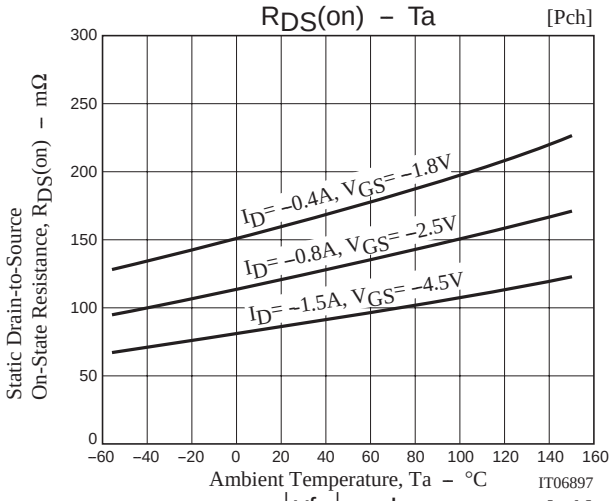



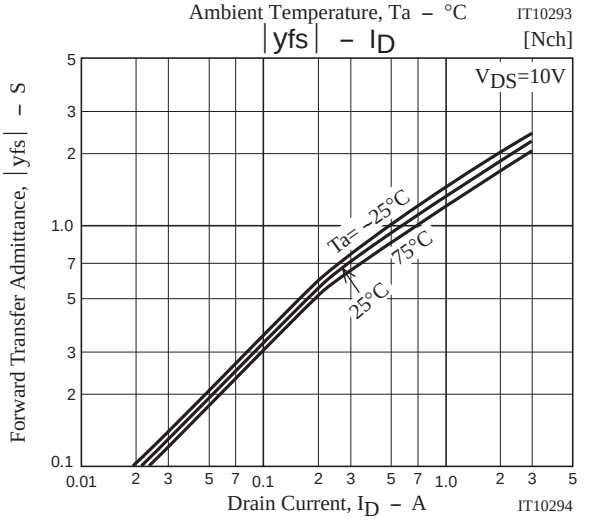



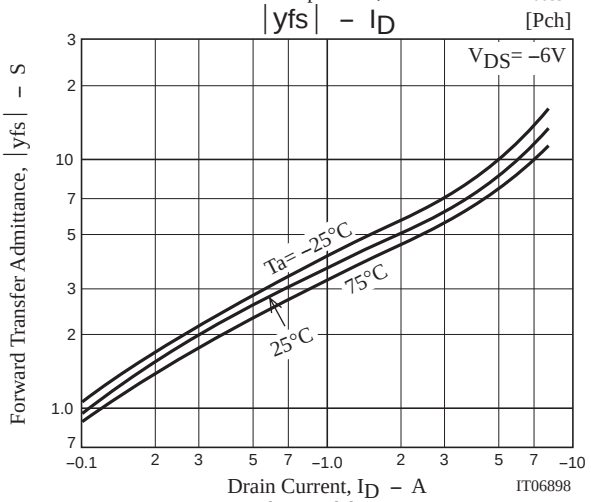



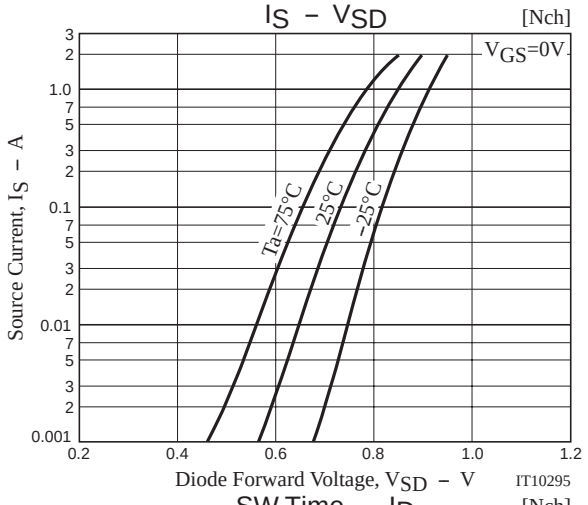



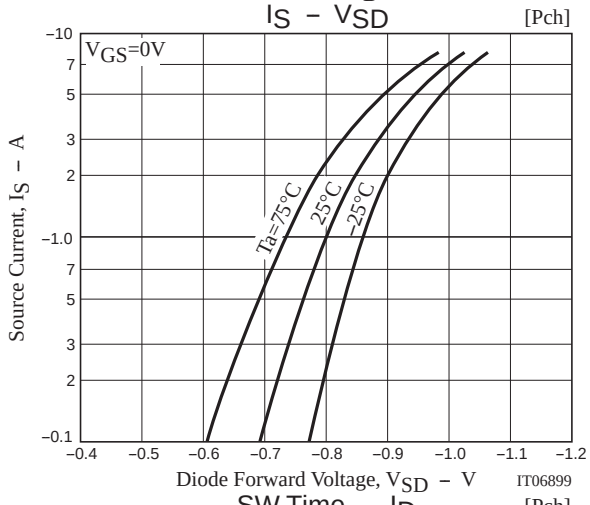

RDS(on) – Ta
[Nch]
Static Drain-to-Source On-State Resistance, RDS(on) – mΩ
ID=0.4A, VGS=4V
ID=0.7A, VGS=10V
Ambient Temperature, Ta – °C
IT10293

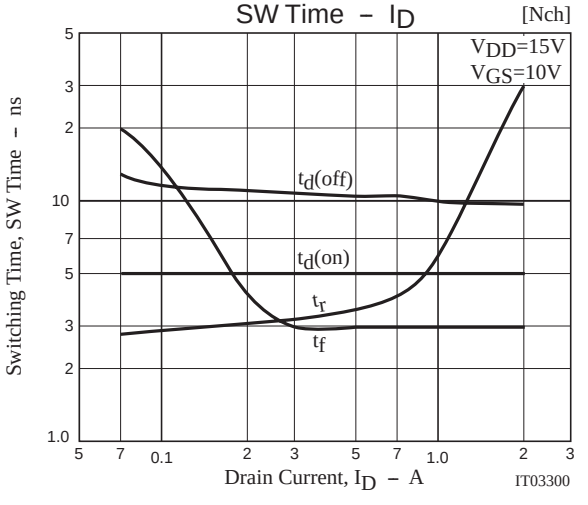

RDS(on) – Ta
[Pch]
Static Drain-to-Source On-State Resistance, RDS(on) – mΩ
ID= –0.4A, VGS= –1.8V
ID= –0.8A, VGS= –2.5V
ID= –1.5A, VGS= –4.5V
Ambient Temperature, Ta – °C
IT06897

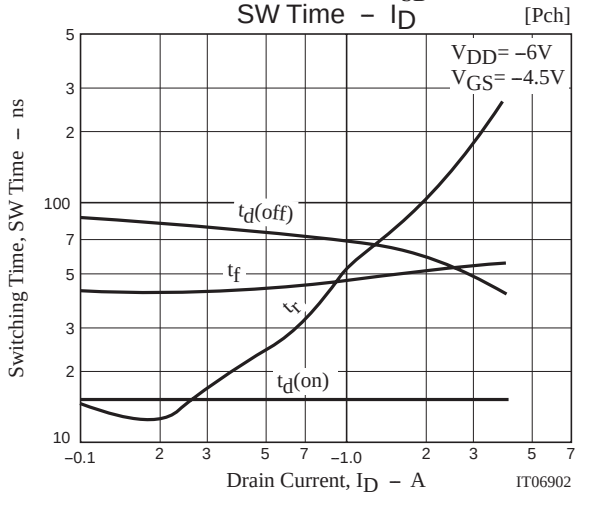

|yfs| – ID
[Nch]
VDS=10V
Forward Transfer Admittance, |yfs| – S
Ta= –25°C
75°C
25°C
Drain Current, ID – A
IT10294


|yfs| – ID
[Pch]
VDS= –6V
Forward Transfer Admittance, |yfs| – S
Ta= –25°C
75°C
25°C
Drain Current, ID – A
IT06898

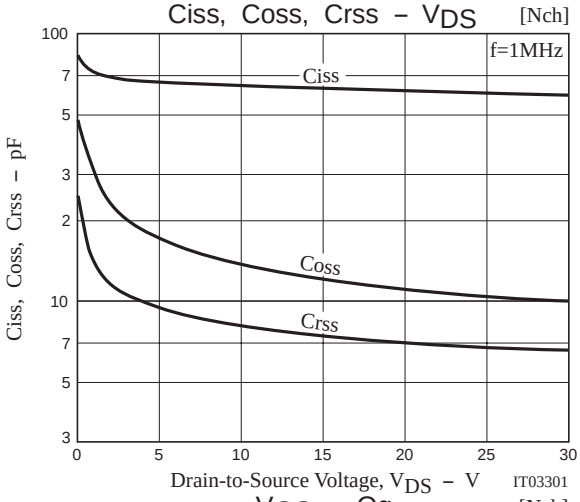

IS – VSD
[Nch]
VGS=0V
Source Current, IS – A
Ta=75°C
25°C
–25°C
Diode Forward Voltage, VSD – V
IT10295


IS – VSD
[Pch]
VGS=0V
Source Current, IS – A
Ta=75°C
25°C
–25°C
Diode Forward Voltage, VSD – V
IT06899

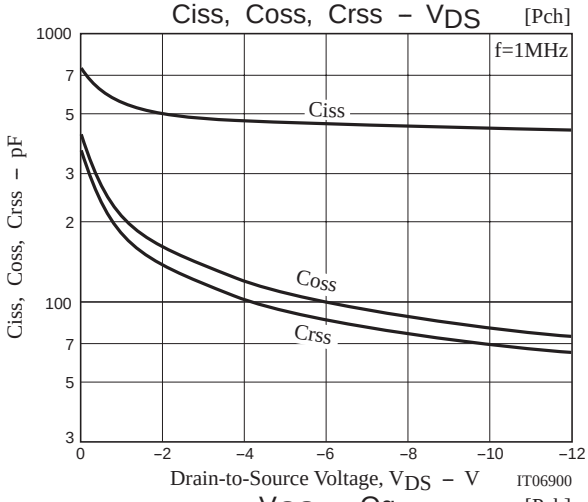

SW Time – ID
[Nch]
VDD=15V
VGS=10V
Switching Time, SW Time – ns
td(off)
td(on)
tr
tf
Drain Current, ID – A
IT03300


SW Time – ID
[Pch]
VDD= –6V
VGS= –4.5V
Switching Time, SW Time – ns
td(off)
tf
tr
td(on)
Drain Current, ID – A
IT06902

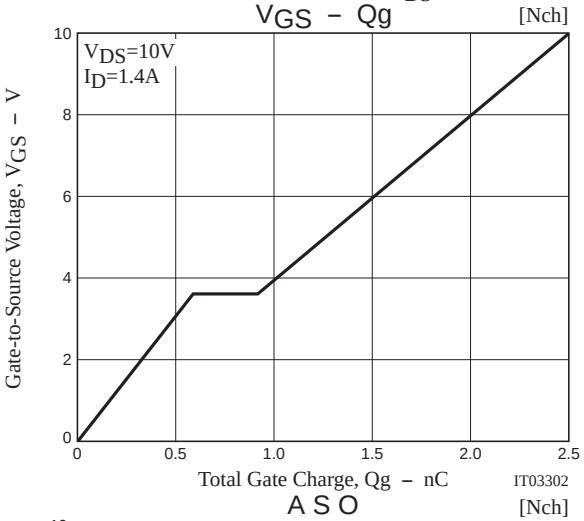
Ciss, Coss, Crss – $V_{DS}$ [Nch]



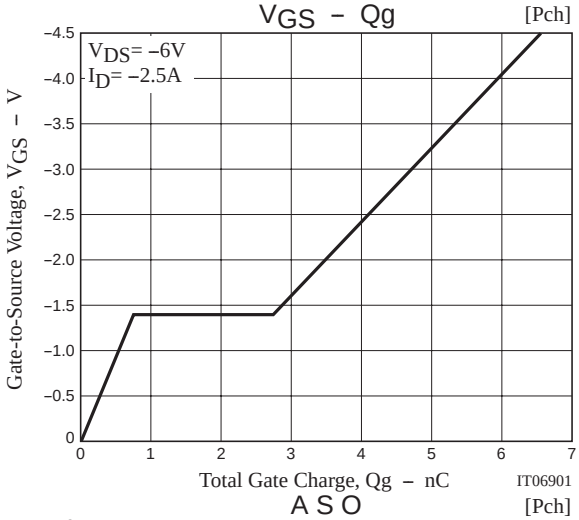

Ciss, Coss, Crss – $V_{DS}$ [Pch]



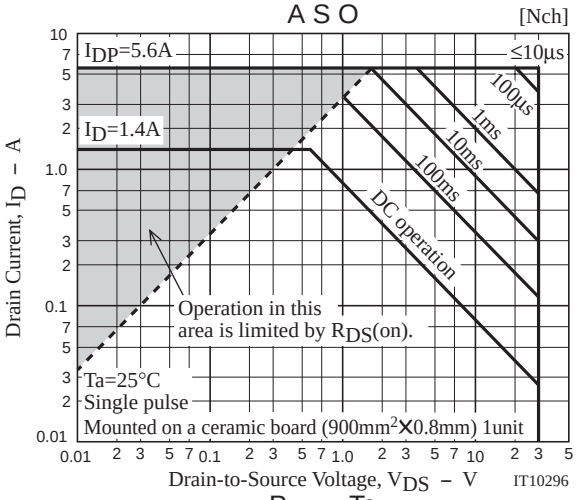

$V_{GS}$ – Qg [Nch]



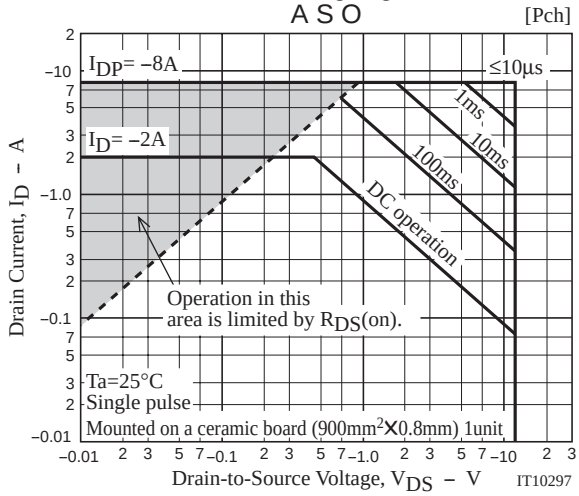

$V_{GS}$ – Qg [Pch]



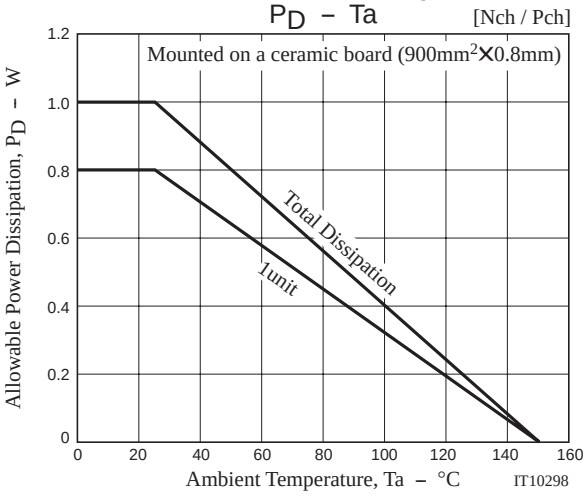

A S O [Nch]




A S O [Pch]




$P_D$ – Ta [Nch / Pch]



Note on usage : Since the VEC2609 is a MOSFET product, please avoid using this device in the vicinity of highly charged objects.