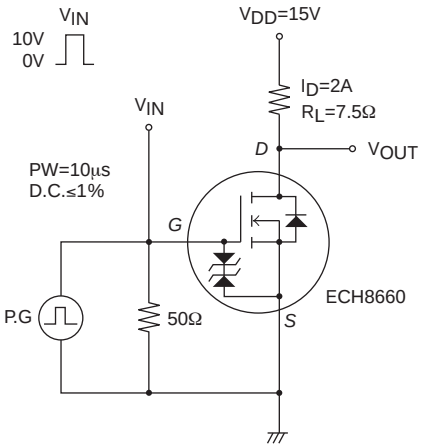
## Electrical Characteristics at Ta=25°C

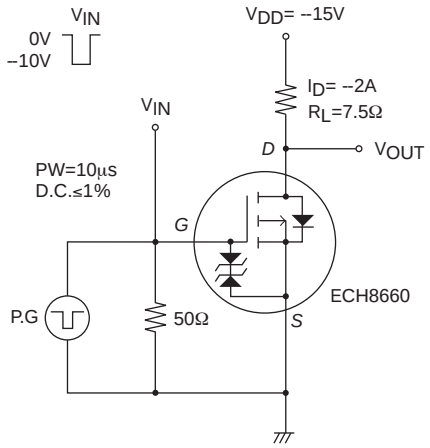
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| [N-channel] | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D$=1mA, $V_{GS}$=0V | 30 | | | V |
| Zero-Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=30V, $V_{GS}$=0V | | | 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, $I_D$=2A | 1 | 1.66 | | S |
| Static Drain-to-Source On-State Resistance | $R_{DS}$(on)1 | $I_D$=2A, $V_{GS}$=10V | | 45 | 59 | mΩ |
| | $R_{DS}$(on)2 | $I_D$=1A, $V_{GS}$=4.5V | | 85 | 119 | mΩ |
| | $R_{DS}$(on)3 | $I_D$=1A, $V_{GS}$=4V | | 110 | 155 | mΩ |
| Input Capacitance | Ciss | $V_{DS}$=10V, f=1MHz | | 240 | | pF |
| Output Capacitance | Coss | $V_{DS}$=10V, f=1MHz | | 45 | | pF |
| Reverse Transfer Capacitance | Crss | $V_{DS}$=10V, f=1MHz | | 30 | | pF |
| Turn-ON Delay Time | $t_d$(on) | See specified Test Circuit. | | 6.2 | | ns |
| Rise Time | $t_r$ | See specified Test Circuit. | | 11 | | ns |
| Turn-OFF Delay Time | $t_d$(off) | See specified Test Circuit. | | 17 | | ns |
| Fall Time | $t_f$ | See specified Test Circuit. | | 7.5 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=4.5A | | 4.4 | | nC |
| Gate-to-Source Charge | Qgs | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=4.5A | | 1.1 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | $V_{DS}$=10V, $V_{GS}$=10V, $I_D$=4.5A | | 0.64 | | nC |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=4.5A, $V_{GS}$=0V | | 0.84 | 1.2 | V |
| [P-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 | | −2.3 | V |
| Forward Transfer Admittance | \| yfs \| | $V_{DS}$=−10V, $I_D$=−2A | 2.5 | 4.2 | | S |
| Static Drain-to-Source On-State Resistance | $R_{DS}$(on)1 | $I_D$=−2A, $V_{GS}$=−10V | | 45 | 59 | mΩ |
| | $R_{DS}$(on)2 | $I_D$=−1A, $V_{GS}$=−4.5V | | 71 | 100 | mΩ |
| | $R_{DS}$(on)3 | $I_D$=−1A, $V_{GS}$=−4V | | 82 | 115 | mΩ |
| Input Capacitance | Ciss | $V_{DS}$=−10V, f=1MHz | | 430 | | pF |
| Output Capacitance | Coss | $V_{DS}$=−10V, f=1MHz | | 105 | | pF |
| Reverse Transfer Capacitance | Crss | $V_{DS}$=−10V, f=1MHz | | 75 | | pF |
| Turn-ON Delay Time | $t_d$(on) | See specified Test Circuit. | | 7.5 | | ns |
| Rise Time | $t_r$ | See specified Test Circuit. | | 26 | | ns |
| Turn-OFF Delay Time | $t_d$(off) | See specified Test Circuit. | | 45 | | ns |
| Fall Time | $t_f$ | See specified Test Circuit. | | 35 | | ns |
| Total Gate Charge | Qg | $V_{DS}$=−10V, $V_{GS}$=−10V, $I_D$=−4.5A | | 10 | | nC |
| Gate-to-Source Charge | Qgs | $V_{DS}$=−10V, $V_{GS}$=−10V, $I_D$=−4.5A | | 2.0 | | nC |
| Gate-to-Drain “Miller” Charge | Qgd | $V_{DS}$=−10V, $V_{GS}$=−10V, $I_D$=−4.5A | | 2.5 | | nC |
| Diode Forward Voltage | $V_{SD}$ | $I_S$=−4.5A, $V_{GS}$=0V | | −0.85 | −1.2 | V |

## Switching Time Test Circuit

[N-channel]

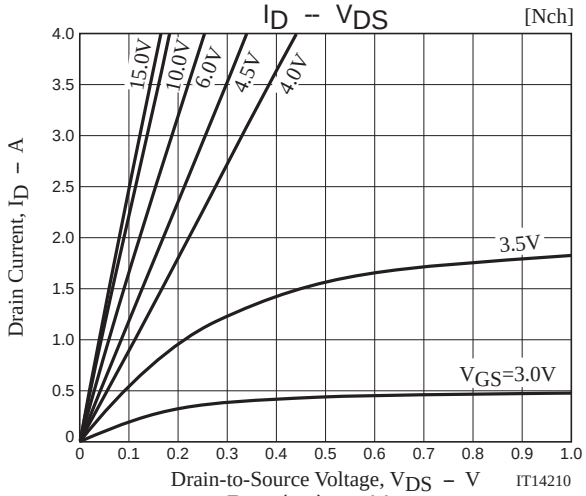


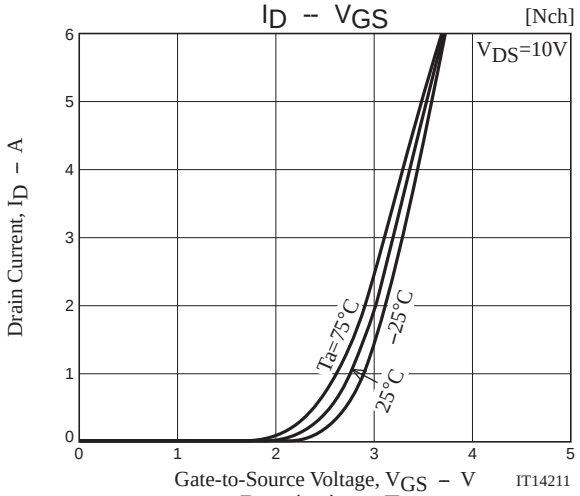

[P-channel]

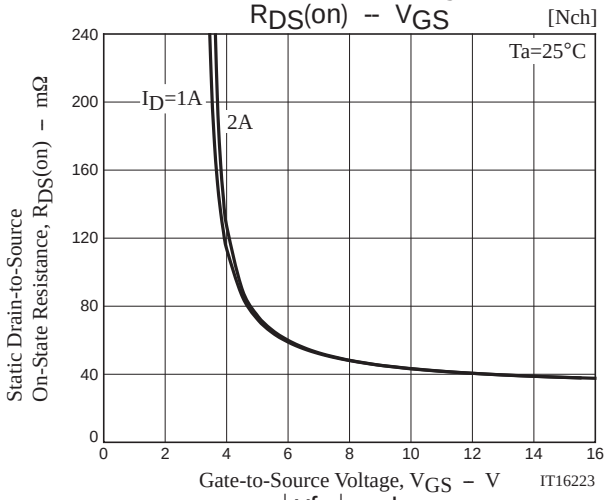


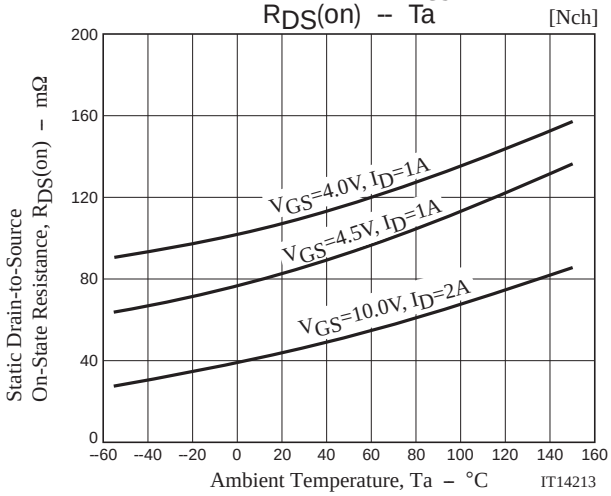
## Ordering Information

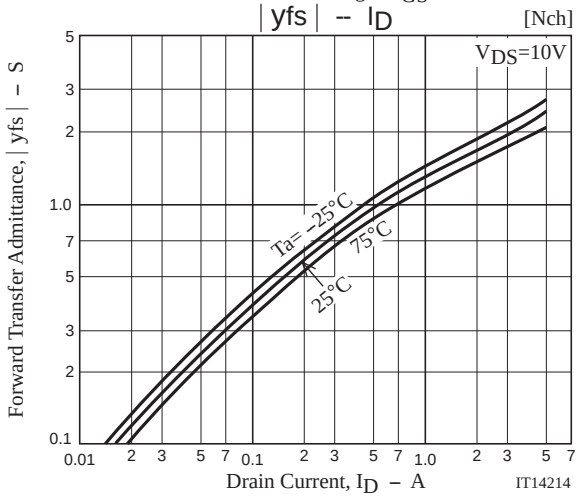
| Device | Package | Shipping | memo |
|---|---|---|---|
| ECH8660-TL-H | ECH8 | 3,000pcs./reel | Pb-Free and Halogen Free |

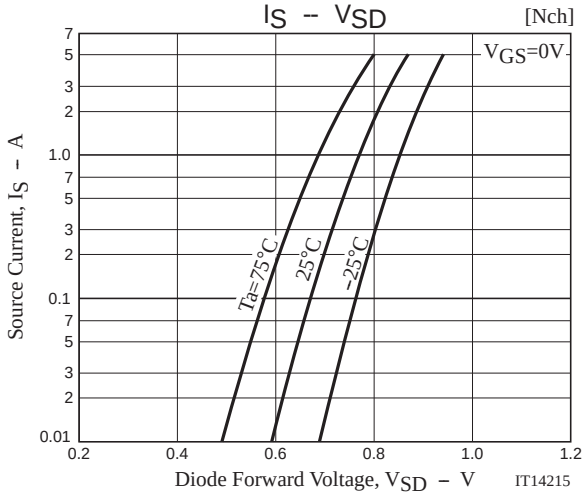


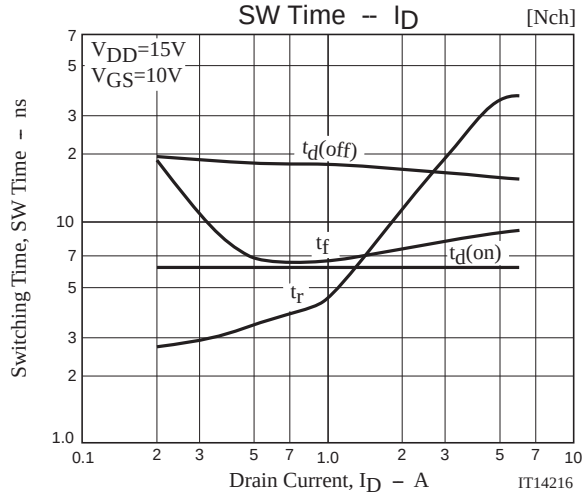



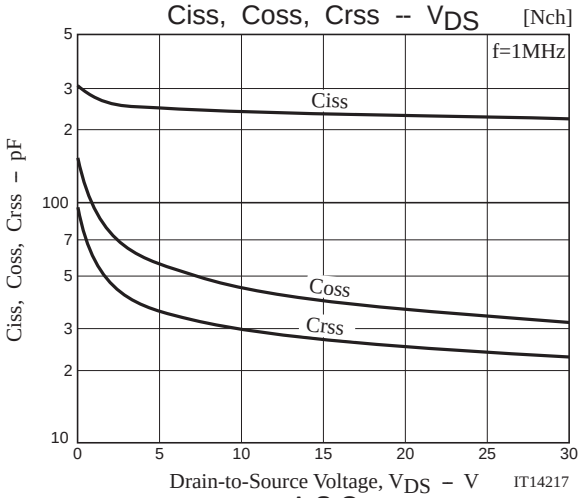



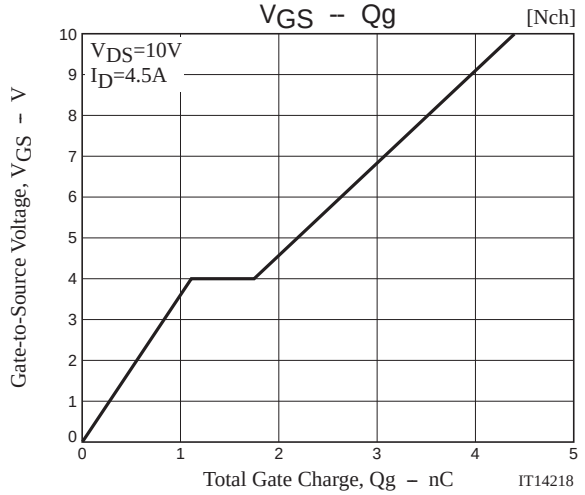
SW Time -- $I_D$ [Nch]



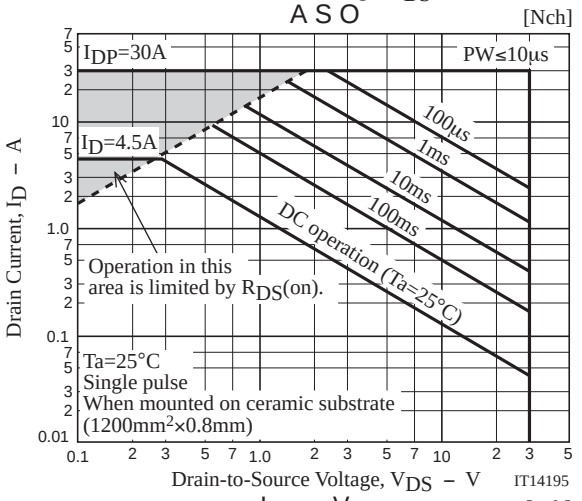

Ciss, Coss, Crss -- $V_{DS}$ [Nch]



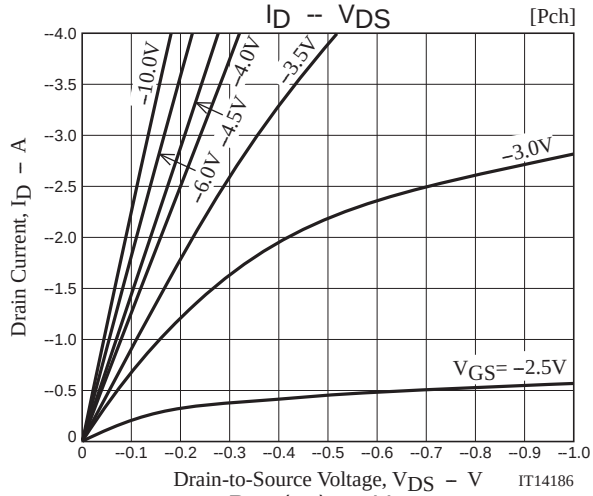

$V_{GS}$ -- Qg [Nch]



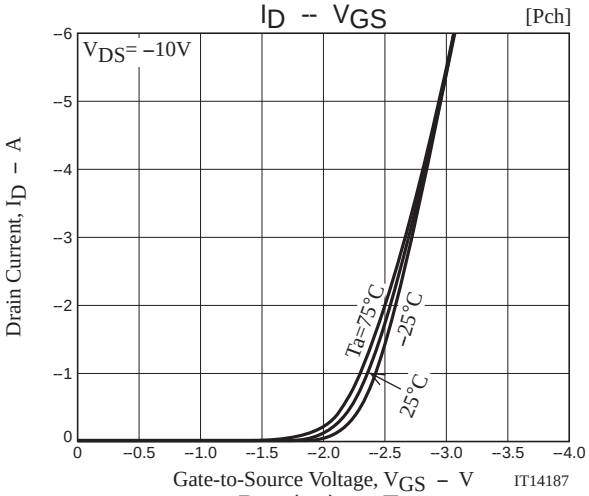

A S O [Nch]



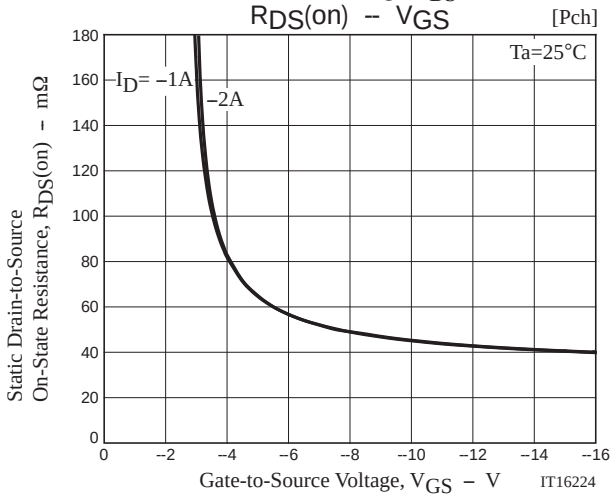

$I_D$ -- $V_{DS}$ [Pch]



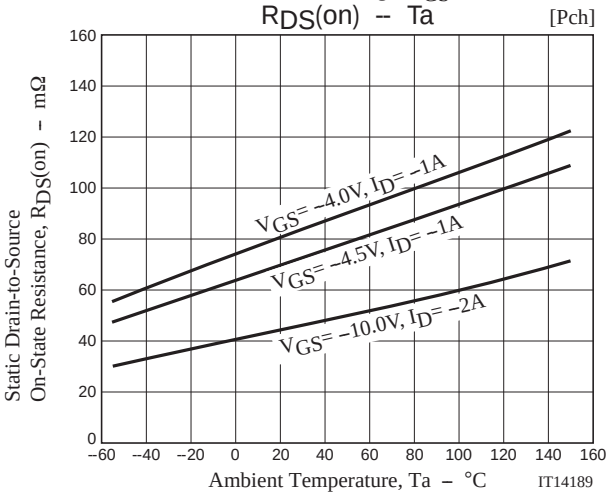

$I_D$ -- $V_{GS}$ [Pch]

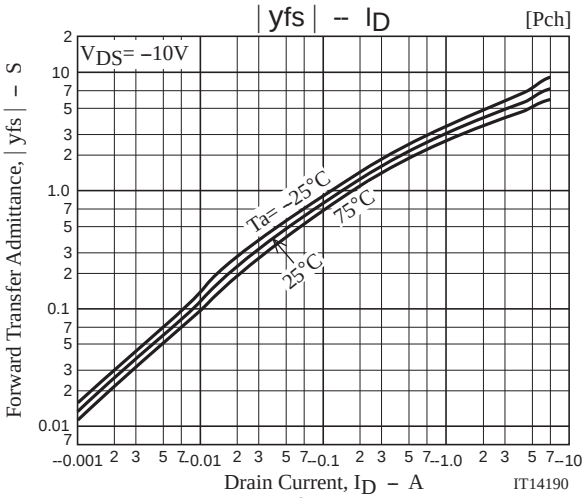


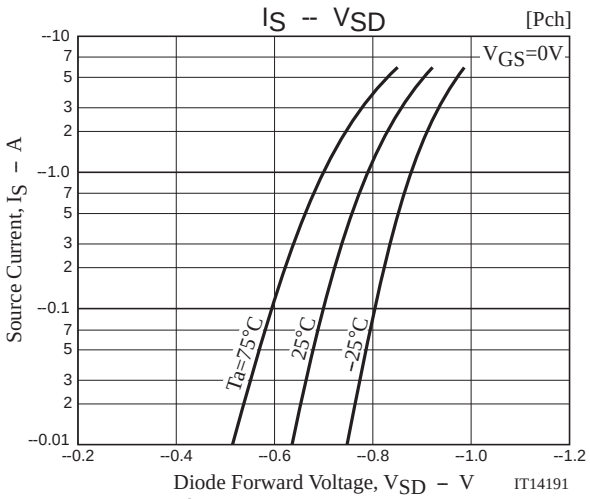

$R_{DS(on)}$ -- $V_{GS}$ [Pch]

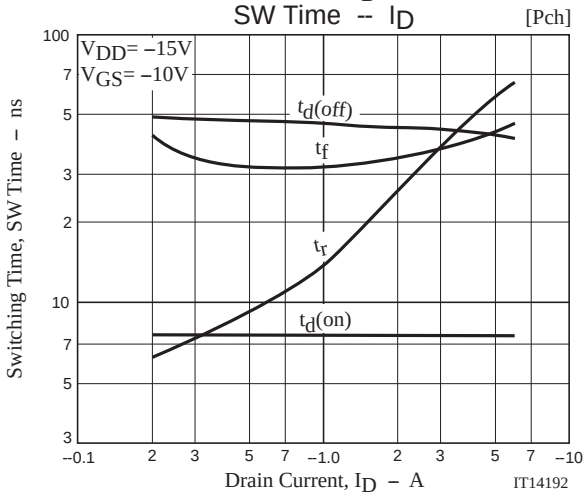


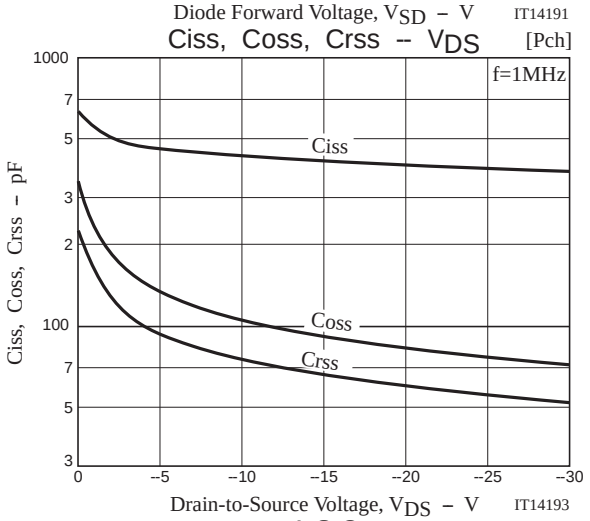

$R_{DS(on)}$ -- Ta [Pch]

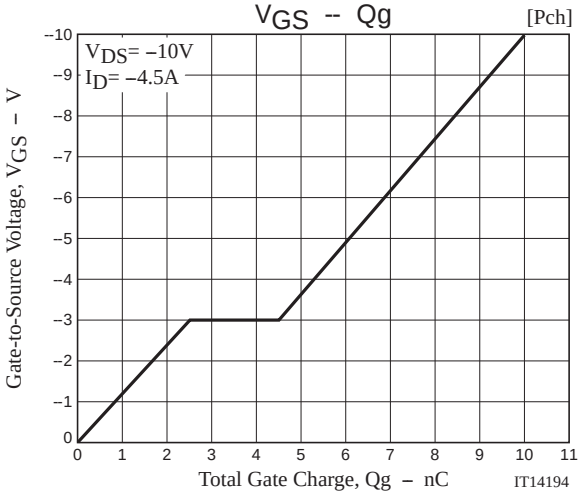


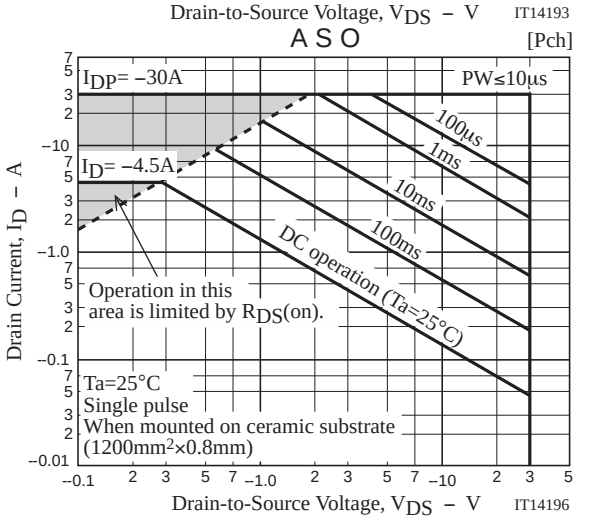


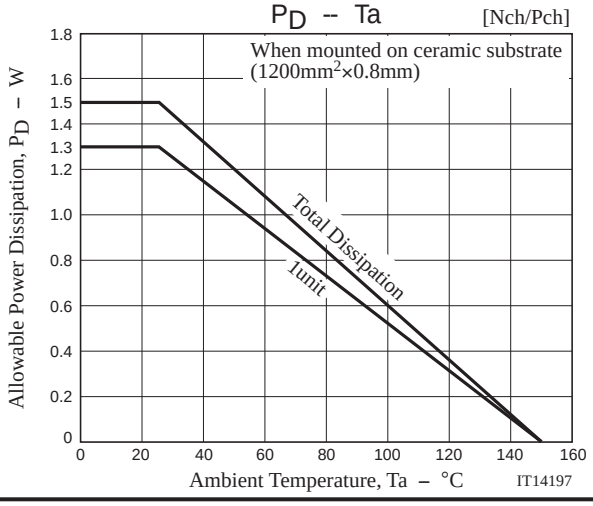



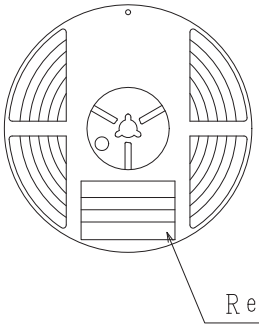
**Embossed Taping Specification**

ECH8660-TL-H

## 1. Packing Format

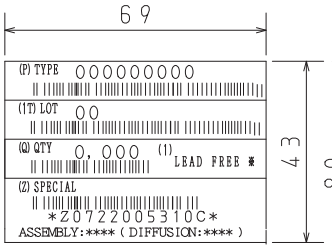
| Package Name | Carrier Tape Type | Maximum Number of devices contained (pcs) | | | Packing format | |
|---|---|---|---|---|---|---|
| | | Reel | Inner box | Outer box | Inner BOX (C-1) | Outer BOX (A-7) |
| ECH8 | CPH6 | 3,000 | 15,000 | 90,000 | 5 reels contained<br>Dimensions:mm(external)<br>183×72×185 | 6 inner boxes contained<br>Dimensions:mm(external)<br>440×195×210 |

Packing method



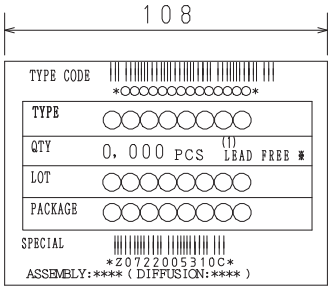

Reel label, Inner box label

(unit:mm)




Outer box label

It is a label at the time of factory shipments. The form of a label may change in physical distribution process.



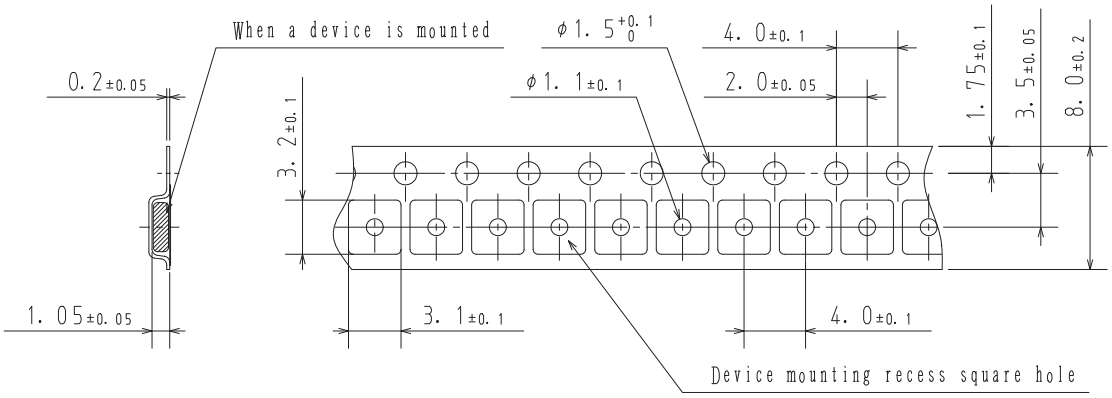

NOTE (1)

The LEAD FREE ※ description shows that the surface treatment of the terminal is lead free.

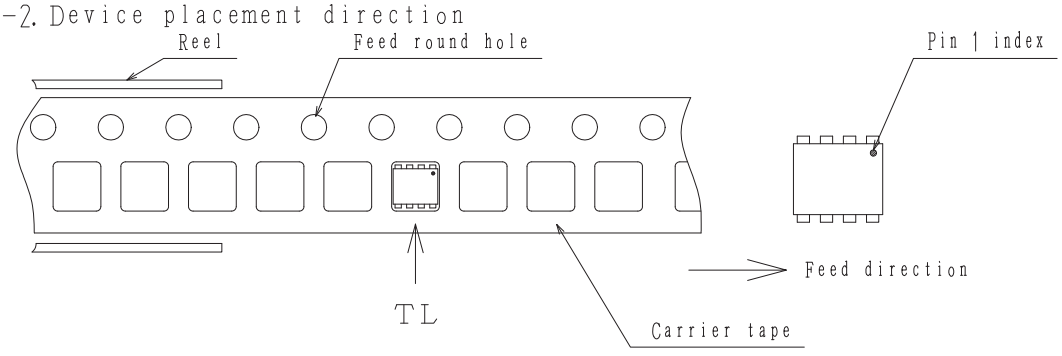
| Label | JEITA Phase |
|---|---|
| LEAD FREE 3 | JEITA Phase 3A |
| LEAD FREE 4 | JEITA Phase 3 |

## 2. Taping configuration

### 2-1. Carrier tape size (unit:mm)



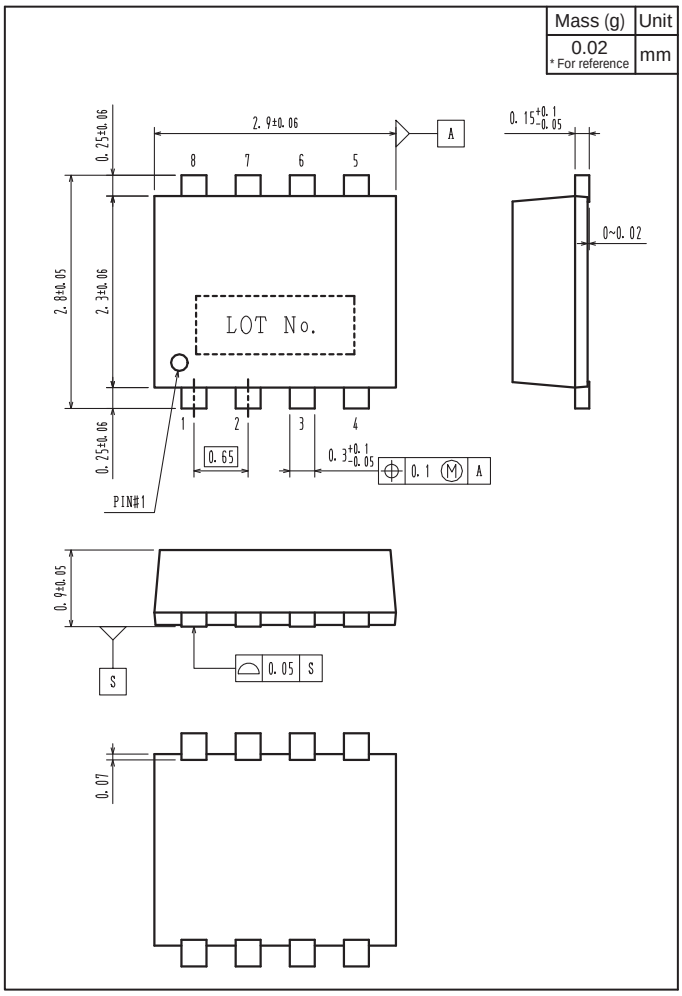

### 2-2. Device placement direction



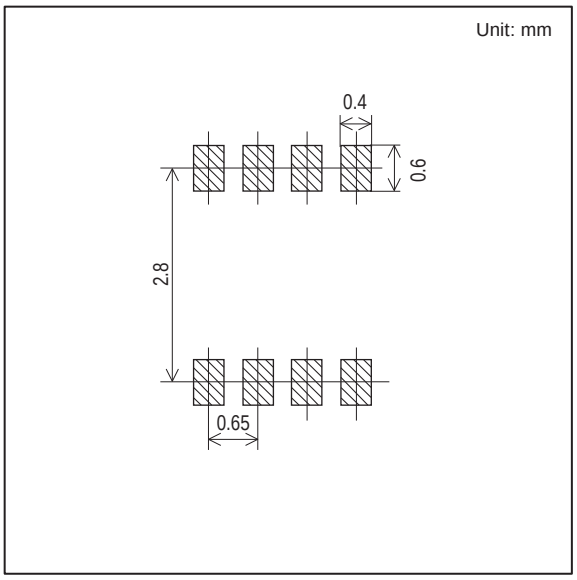

Those with pin 1 index on the feed hole side·····TL

## Outline Drawing

ECH8660-TL-H




## Land Pattern Example



Note on usage : Since the ECH8660 is a MOSFET product, please avoid using this device in the vicinity of highly charged objects.