

## -20V P-Channel Enhancement Mode MOSFET

### DESCRIPTION

The SMC3401E is the P-Channel logic enhancement mode power field effect transistor is produced using high cell density, advanced trench technology to provide excellent  $R_{DS(ON)}$ .

This device is suitable for use as a load switch or in PWM and gate charge for most of the synchronous buck converter applications.

*SMC3401ES-TRG ROHS Compliant This is Halogen Free*

### FEATURE

- ◆ -20V/-4.3A,  $R_{DS(ON)} = 36m\Omega(typ)@V_{GS} = -10V$
- ◆ -20V/-3.5A,  $R_{DS(ON)} = 43m\Omega(typ)@V_{GS} = -4.5V$
- ◆ -20V/-2.5A,  $R_{DS(ON)} = 55m\Omega(typ)@V_{GS} = -2.5V$
- ◆ Super high density cell design for extremely low  $R_{DS(ON)}$
- ◆ Exceptional on-resistance and maximum DC current capability

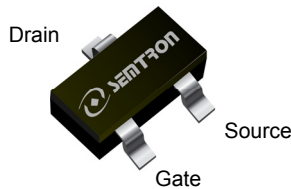
### FEATURE

- ◆ DC/DC Converter
- ◆ Load Switch
- ◆ Mobile Battery Powered System

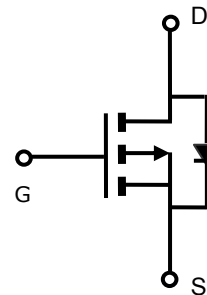


P-Channel Enhancement Mode MOSFET

### PIN CONFIGURATION



SOT-23L  
Top View



### PART NUMBER INFORMATION

|   |   |
|---|---|
| <p><b>SMC 3401E S - TR G</b></p> <p>a      b      c      d      e</p> | <p>a : Company name.<br/> b : Product Serial number.<br/> c : Package code<br/> d : Handling code<br/> e : Green produce code</p> |
|---|---|

## ORDERING INFORMATION

| Part Number   | Package Code | Handling Code  | Shipping |
|---------------|--------------|----------------|----------|
| SMC3401ES-TRG | S : SOT-23L  | TR : Tape&Reel | 3K/Reel  |

- ※ Year Code : 0 ~ 9, 2010 : 0
- ※ Week Code : A(1~2) ~ Z(53~54)
- ※ SOT-23L : Only available in tape and reel packaging.

## ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ Unless otherwise noted)

| Symbol    | Parameter  | Typical                | Unit             |   |
|-----------|--|------------------------|------------------|---|
| $V_{DSS}$ | Drain-Source Voltage   | -20                    | V                |   |
| $V_{GSS}$ | Gate-Source Voltage  | $\pm 12$               | V                |   |
| $I_D$     | Continuous Drain Current ( $T_C=25^\circ\text{C}$ ) <sup>A</sup> | $V_{GS}=-12\text{V}$   | -4.3             | A |
|           | Continuous Drain Current ( $T_C=70^\circ\text{C}$ ) <sup>A</sup> |                        | -3.6             | A |
| $I_{DM}$  | Pulsed Drain Current <sup>B</sup>                                | -20                    | A                |   |
| $P_D$     | Power Dissipation  | $T_A=25^\circ\text{C}$ | 1.52             | W |
|           |  | $T_A=70^\circ\text{C}$ | 1.08             |   |
| $T_J$     | Operation Junction Temperature                                   | -55 to 150             | $^\circ\text{C}$ |   |
| $T_{STG}$ | Storage Temperature Range  | -55 to 150             | $^\circ\text{C}$ |   |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.  
 Absolute maximum ratings are stress ratings only and functional device operation is not implied.

## THERMAL DATA

| Symbol          | Parameter   | Typ          | Max | Unit |                           |
|-----------------|---|--------------|-----|------|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance-Junction to Ambient <sup>A</sup> | Steady-State | -   | 120  | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JL}$ | Thermal Resistance Junction to Lead <sup>A</sup>    | Steady-State | -   | 80   | $^\circ\text{C}/\text{W}$ |

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C Unless otherwise noted)

| Symbol                    | Parameter                                       | Condition  | Min  | Typ   | Max  | Unit |
|---------------------------|---|--|------|-------|------|------|
| <b>Static Parameters</b>  |   |  |      |       |      |      |
| V <sub>(BR)DSS</sub>      | Drain-Source Breakdown Voltage                  | V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA  | -20  |       |      | V    |
| V <sub>GS(th)</sub>       | Gate Threshold Voltage                          | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                      | -0.4 | -0.65 | -1.0 | V    |
| I <sub>GSS</sub>          | Gate Leakage Current                            | V <sub>DS</sub> =0V, V <sub>GS</sub> =±12V   |      |       | ±100 | nA   |
| I <sub>DSS</sub>          | Zero Gate Voltage, Drain-Source Leakage Current | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =25°C                             |      |       | -1   | μA   |
|                           |   | V <sub>DS</sub> =-16V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =55°C                             |      |       | -5   |      |
| R <sub>DS(ON)</sub>       | Drain-source On-Resistance <sup>B</sup>         | V <sub>GS</sub> =-10V, I <sub>D</sub> =-4.3A   |      | 36    | 40   | mΩ   |
|                           |   | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3.5A  |      | 43    | 48   |      |
|                           |   | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-2.5A  |      | 55    | 65   |      |
| <b>Source-Drain Diode</b> |   |  |      |       |      |      |
| V <sub>SD</sub>           | Diode Forward Voltage                           | I <sub>S</sub> =-1.0A, V <sub>GS</sub> =0V   |      | -0.7  | -1.0 | V    |
| I <sub>S</sub>            | Continuous Source Current <sup>AD</sup>         |  |      |       | -1   | A    |
| <b>Dynamic Parameters</b> |   |  |      |       |      |      |
| Q <sub>g</sub> (-4.5V)    | Total Gate Charge                               | V <sub>DS</sub> =-15V<br>V <sub>GS</sub> =-10V<br>I <sub>D</sub> =-4.3A                        |      | 9.8   |      | nC   |
| Q <sub>gs</sub>           | Gate-Source Charge                              |  |      | 2.1   |      |      |
| Q <sub>gd</sub>           | Gate-Drain Charge                               |  |      | 2.8   |      |      |
| C <sub>iss</sub>          | Input Capacitance                               | V <sub>DS</sub> =-15V<br>V <sub>GS</sub> =0V<br>f=1MHz   |      | 968   |      | pF   |
| C <sub>oss</sub>          | Output Capacitance                              |  |      | 132   |      |      |
| C <sub>rss</sub>          | Reverse Transfer Capacitance                    |  |      | 76    |      |      |
| t <sub>d(on)</sub>        | Turn-On Time                                    | V <sub>DD</sub> =-15V<br>I <sub>D</sub> =-4.3A<br>V <sub>GEN</sub> =-10V<br>R <sub>G</sub> =6Ω |      | 6.6   |      | nS   |
| t <sub>r</sub>            |   |  |      | 3     |      |      |
| t <sub>d(off)</sub>       | Turn-Off Time                                   |  |      | 33    |      |      |
| t <sub>f</sub>            |   |  |      | 13    |      |      |

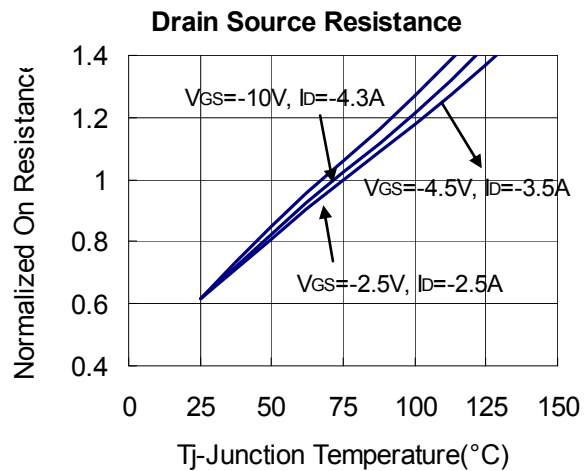
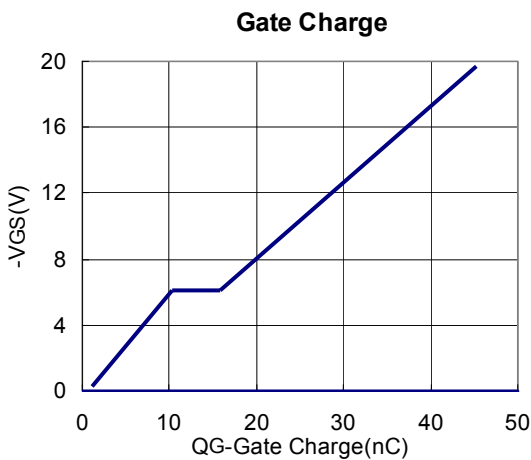
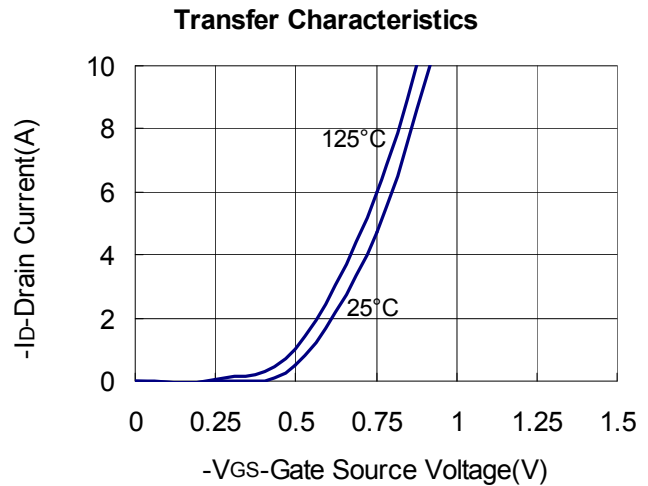
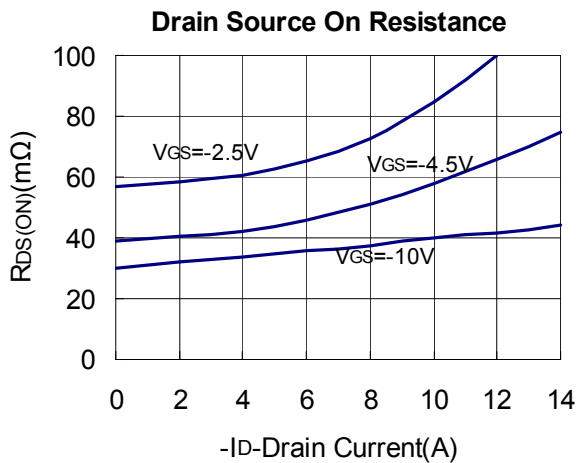
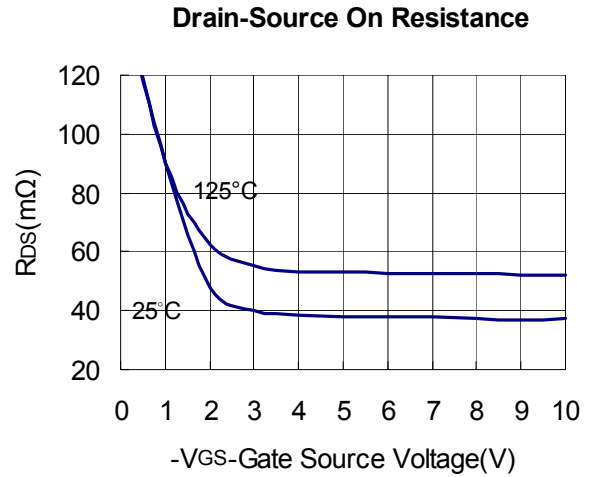
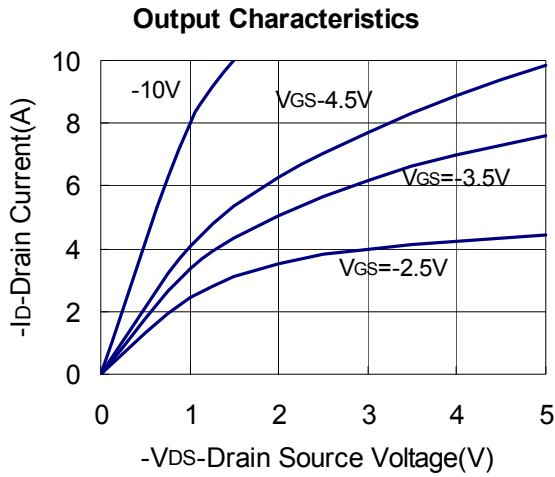
Note:

- The value of R<sub>θJA</sub> is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C.
- The data tested by pulsed, pulse width ≤ 300μs, duty cycle ≤ 2%
- The EAS data shows Max. rating. The test condition is V<sub>DD</sub>=-25V, V<sub>GS</sub>=-10V, L=0.1mH.
- The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.

The products and product specifications contained herein are subject to change without notice to improve performance characteristics. Consult us, or our representatives before use, to confirm that the information in this datasheet is up to date

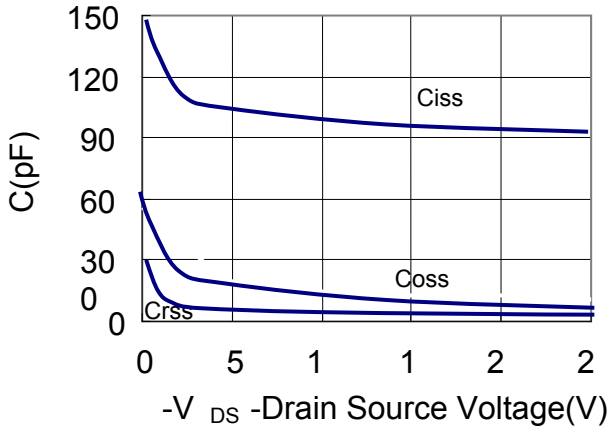
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## TYPICAL CHARACTERISTICS (25°C Unless Note)

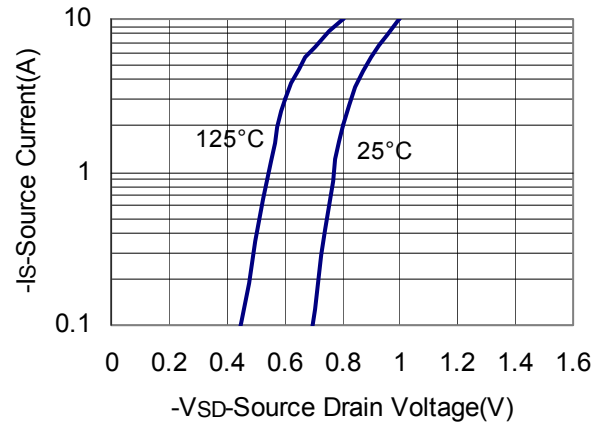


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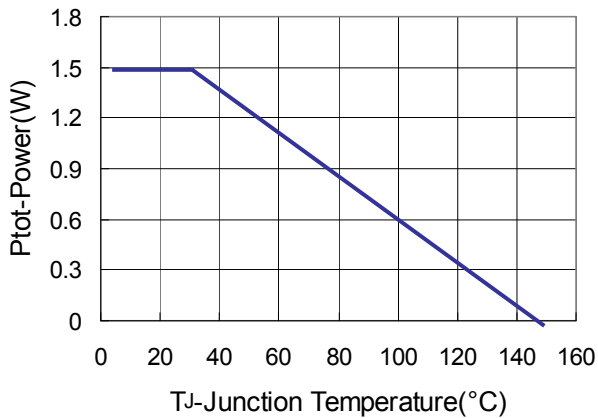
### Capacitance



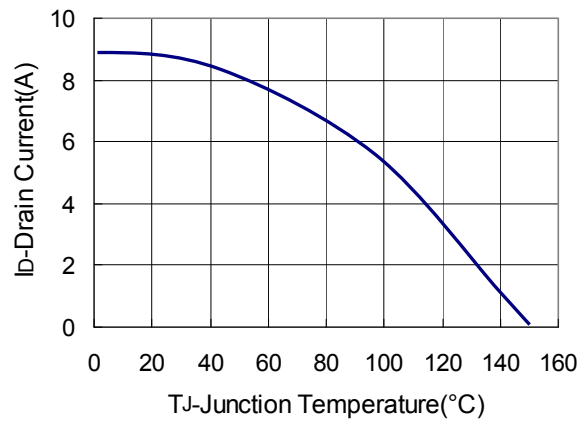
### Source Drain Diode Forward



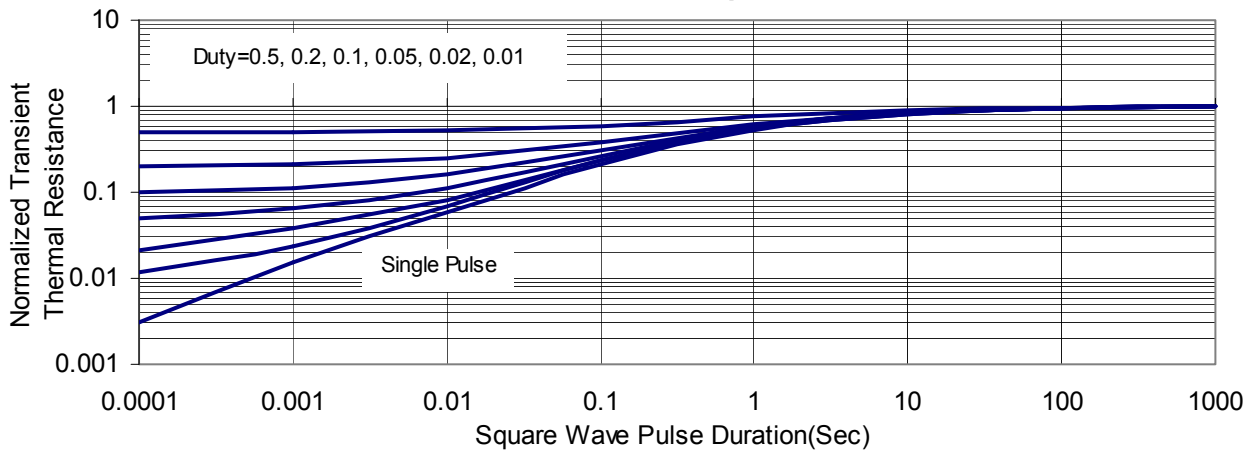
### Power Dissipation



### Drain Current



### Thermal Transient Impedance



## SOT-23L PACKAGE DIMENSIONS

| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min.                      | Max.  | Min.                 | Max.  |
| A        | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1       | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2       | 1.050                     | 1.150 | 0.041                | 0.045 |
| b        | 0.300                     | 0.500 | 0.012                | 0.020 |
| c        | 0.100                     | 0.200 | 0.004                | 0.008 |
| D        | 2.820                     | 3.020 | 0.111                | 0.119 |
| E        | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1       | 2.650                     | 2.950 | 0.104                | 0.116 |
| e        | 0.950 BSC                 |       | 0.037 BSC            |       |
| e1       | 1.800                     | 2.000 | 0.071                | 0.079 |
| L        | 0.300                     | 0.600 | 0.012                | 0.024 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

SOT-23L PACKAGE OUTLINE DIMENSIONS

