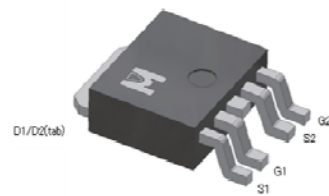
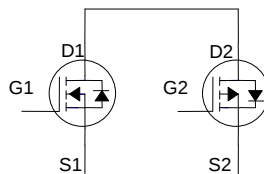


N & P-Channel Logic Level Enhancement Mode Field Effect Transistor

Product Summary:

|                     | N-CH         | P-CH         |
|---------------------|--------------|--------------|
| $BV_{DSS}$          | 25V          | -25V         |
| $R_{DS(on)} (MAX.)$ | 20m $\Omega$ | 60m $\Omega$ |
| $I_D$               | 15A          | -10A         |



Pb-Free Lead Plating & Halogen Free



ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$  Unless Otherwise Noted)

| PARAMETERS/TEST CONDITIONS                     |                                     |  | SYMBOL         | LIMITS     |      | UNIT               |
|------------------------------------------------|-------------------------------------|--|----------------|------------|------|--------------------|
| Gate-Source Voltage                            |                                     |  | $V_{GS}$       | N-CH       | P-CH | V                  |
|                                                |                                     |  |                | ±20        | ±20  |                    |
| Continuous Drain Current                       | $T_C = 25\text{ }^{\circ}\text{C}$  |  | $I_D$          | 15         | -10  | A                  |
|                                                | $T_C = 100\text{ }^{\circ}\text{C}$ |  |                | 10         | -6.5 |                    |
| Pulsed Drain Current <sup>1</sup>              |                                     |  | $I_{DM}$       | 60         | -40  |                    |
| Power Dissipation                              | $T_C = 25\text{ }^{\circ}\text{C}$  |  | $P_D$          | 21         |      | W                  |
|                                                | $T_C = 100\text{ }^{\circ}\text{C}$ |  |                | 8.3        |      |                    |
| Operating Junction & Storage Temperature Range |                                     |  | $T_J, T_{stg}$ | -55 to 150 |      | $^{\circ}\text{C}$ |

THERMAL RESISTANCE RATINGS

| THERMAL RESISTANCE  | SYMBOL          | TYPICAL | MAXIMUM | UNIT                        |
|---------------------|-----------------|---------|---------|-----------------------------|
| Junction-to-Case    | $R_{\theta JC}$ |         | 6       | $^\circ\text{C} / \text{W}$ |
| Junction-to-Ambient | $R_{\theta JA}$ |         | 90      |                             |

<sup>1</sup>Pulse width limited by maximum junction temperature.

<sup>2</sup>Duty cycle  $\leq 1\%$

ELECTRICAL CHARACTERISTICS ( $T_c = 25\text{ }^{\circ}\text{C}$ , Unless Otherwise Noted)

| PARAMETER                                     | SYMBOL        | TEST CONDITIONS                                                                                 | LIMITS |      |      | UNIT      |         |
|-----------------------------------------------|---------------|-------------------------------------------------------------------------------------------------|--------|------|------|-----------|---------|
|                                               |               |                                                                                                 | MIN    | TYP  | MAX  |           |         |
| STATIC                                        |               |                                                                                                 |        |      |      |           |         |
| Drain-Source Breakdown Voltage                | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$                                                                   | N-CH   | 25   |      |           | V       |
|                                               |               | $V_{GS} = 0V, I_D = -250\mu A$                                                                  | P-CH   | -25  |      |           |         |
| Gate Threshold Voltage                        | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu A$                                                               | N-CH   | 1    | 1.7  | 3         |         |
|                                               |               | $V_{DS} = V_{GS}, I_D = -250\mu A$                                                              | P-CH   | -0.7 | -1.3 | -2        |         |
| Gate-Body Leakage                             | $I_{GSS}$     | $V_{DS} = 0V, V_{GS} = \pm 20V$                                                                 | N-CH   |      |      | $\pm 100$ | nA      |
|                                               |               | $V_{DS} = 0V, V_{GS} = \pm 20V$                                                                 | P-CH   |      |      | $\pm 100$ |         |
| Zero Gate Voltage Drain Current               | $I_{DSS}$     | $V_{DS} = 20V, V_{GS} = 0V$                                                                     | N-CH   |      |      | 1         | $\mu A$ |
|                                               |               | $V_{DS} = -20V, V_{GS} = 0V$                                                                    | P-CH   |      |      | -1        |         |
|                                               |               | $V_{DS} = 20V, V_{GS} = 0V, T_J = 125\text{ }^{\circ}C$                                         | N-CH   |      |      | 25        |         |
|                                               |               | $V_{DS} = -20V, V_{GS} = 0V, T_J = 125\text{ }^{\circ}C$                                        | P-CH   |      |      | -25       |         |
| On-State Drain Current <sup>1</sup>           | $I_{D(ON)}$   | $V_{DS} = 5V, V_{GS} = 10V$                                                                     | N-CH   | 15   |      |           | A       |
|                                               |               | $V_{DS} = -5V, V_{GS} = -10V$                                                                   | P-CH   | -10  |      |           |         |
| Drain-Source On-State Resistance <sup>1</sup> | $R_{DS(ON)}$  | $V_{GS} = 10V, I_D = 15A$                                                                       | N-CH   |      | 15.5 | 20        | mΩ      |
|                                               |               | $V_{GS} = -10V, I_D = -10A$                                                                     | P-CH   |      | 48   | 60        |         |
|                                               |               | $V_{GS} = 5V, I_D = 10A$                                                                        | N-CH   |      | 23   | 30        |         |
|                                               |               | $V_{GS} = -5V, I_D = -8A$                                                                       | P-CH   |      | 60   | 80        |         |
| Forward Transconductance <sup>1</sup>         | $g_{fs}$      | $V_{DS} = 5V, I_D = 15A$                                                                        | N-CH   |      | 15   |           | S       |
|                                               |               | $V_{DS} = -5V, I_D = -10A$                                                                      | P-CH   |      | 16   |           |         |
| DYNAMIC                                       |               |                                                                                                 |        |      |      |           |         |
|                                               |               |                                                                                                 |        |      |      |           |         |
| Input Capacitance                             | $C_{iss}$     | N-CH<br>$V_{GS} = 0V, V_{DS} = 15V, f = 1MHz$<br>P-CH<br>$V_{GS} = 0V, V_{DS} = -15V, f = 1MHz$ | N-CH   |      | 520  |           | pF      |
| Output Capacitance                            | $C_{oss}$     |                                                                                                 | P-CH   |      | 520  |           |         |
|                                               |               |                                                                                                 | N-CH   |      | 88   |           |         |
|                                               |               |                                                                                                 | P-CH   |      | 82   |           |         |
|                                               |               |                                                                                                 | N-CH   |      | 62   |           |         |
| Reverse Transfer Capacitance                  | $C_{rss}$     |                                                                                                 | P-CH   |      | 61   |           |         |

|                                                                         |                     |                                                                                                                                                                                                                      |      |     |      |      |    |
|-------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|------|------|----|
| Total Gate Charge <sup>1,2</sup>                                        | Q <sub>g</sub>      | N-CH<br>V <sub>DS</sub> = 15V, V <sub>GS</sub> = 10V,<br>I <sub>D</sub> = 15A<br>P-CH<br>V <sub>DS</sub> = -15V, V <sub>GS</sub> = -10V,<br>I <sub>D</sub> = -10A                                                    | N-CH |     | 11.5 |      | nC |
| Gate-Source Charge <sup>1,2</sup>                                       | Q <sub>gs</sub>     |                                                                                                                                                                                                                      | P-CH |     | 8.6  |      |    |
| Gate-Drain Charge <sup>1,2</sup>                                        | Q <sub>gd</sub>     |                                                                                                                                                                                                                      | N-CH |     | 1.6  |      |    |
|                                                                         |                     |                                                                                                                                                                                                                      | P-CH |     | 1.4  |      |    |
| Turn-On Delay Time <sup>1,2</sup>                                       | t <sub>d(on)</sub>  |                                                                                                                                                                                                                      | N-CH |     | 2.8  |      |    |
|                                                                         |                     | P-CH                                                                                                                                                                                                                 |      | 1.8 |      |      |    |
| Rise Time <sup>1,2</sup>                                                | t <sub>r</sub>      | N-CH<br>V <sub>DS</sub> = 15V,<br>I <sub>D</sub> = 15A, V <sub>GS</sub> = 10V, R <sub>GS</sub> = 12.7Ω<br><br>P-CH<br>V <sub>DS</sub> = -15V,<br>I <sub>D</sub> = -10A, V <sub>GS</sub> = -10V, R <sub>GS</sub> = 6Ω | N-CH |     | 11   |      | nS |
| Turn-Off Delay Time <sup>1,2</sup>                                      | t <sub>d(off)</sub> |                                                                                                                                                                                                                      | P-CH |     | 5.5  |      |    |
|                                                                         |                     |                                                                                                                                                                                                                      | N-CH |     | 16   |      |    |
| Fall Time <sup>1,2</sup>                                                | t <sub>f</sub>      |                                                                                                                                                                                                                      | P-CH |     | 10   |      |    |
|                                                                         |                     |                                                                                                                                                                                                                      | N-CH |     | 36   |      |    |
|                                                                         |                     | P-CH                                                                                                                                                                                                                 |      | 18  |      |      |    |
|                                                                         |                     | N-CH                                                                                                                                                                                                                 |      | 20  |      |      |    |
|                                                                         |                     | P-CH                                                                                                                                                                                                                 |      | 15  |      |      |    |
| SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS (T <sub>c</sub> = 25 °C) |                     |                                                                                                                                                                                                                      |      |     |      |      |    |
| Continuous Current                                                      | I <sub>S</sub>      |                                                                                                                                                                                                                      | N-CH |     |      | 2.3  | A  |
|                                                                         |                     |                                                                                                                                                                                                                      | P-CH |     |      | -2.3 |    |
| Pulsed Current <sup>3</sup>                                             | I <sub>SM</sub>     |                                                                                                                                                                                                                      | N-CH |     |      | 9.2  |    |
|                                                                         |                     |                                                                                                                                                                                                                      | P-CH |     |      | -9.2 |    |
| Forward Voltage <sup>1</sup>                                            | V <sub>SD</sub>     | I <sub>F</sub> = I <sub>S</sub> , V <sub>GS</sub> = 0V                                                                                                                                                               | N-CH |     |      | 1.3  | V  |
|                                                                         |                     |                                                                                                                                                                                                                      | P-CH |     |      | -1.3 |    |

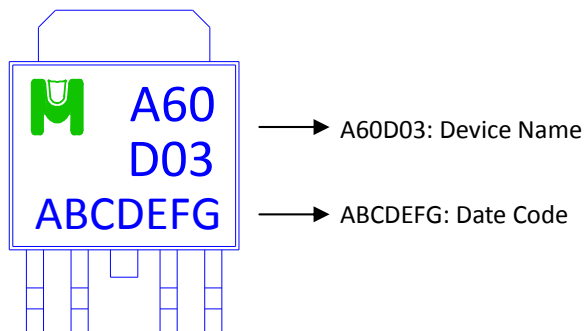
<sup>1</sup>Pulse test : Pulse Width  $\leq 300 \mu sec$ , Duty Cycle  $\leq 2\%$ .

<sup>2</sup>Independent of operating temperature.

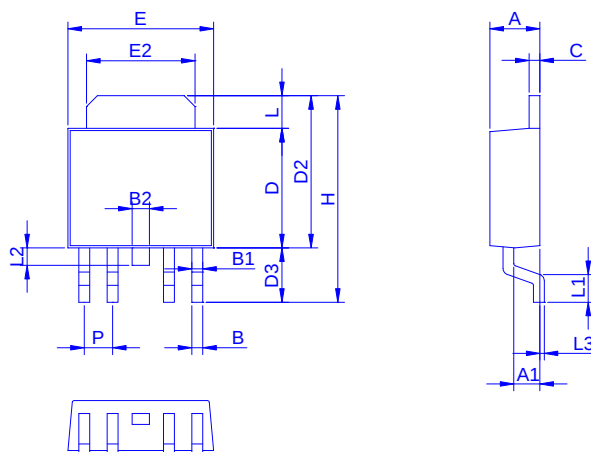
<sup>3</sup>Pulse width limited by maximum junction temperature.

## Ordering & Marking Information:

Device Name: EMA60D03A for DPAK (TO-252)

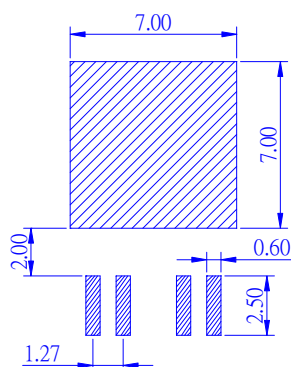


## Outline Drawing



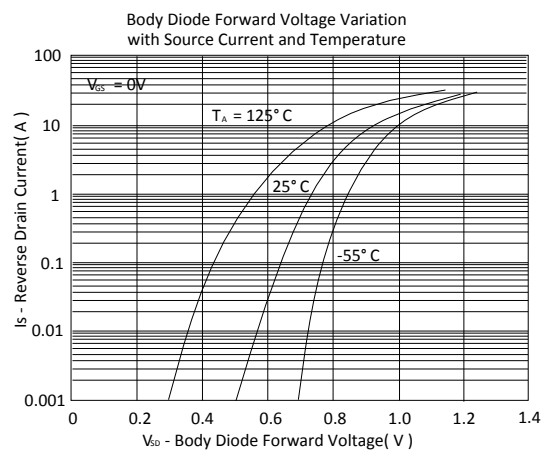
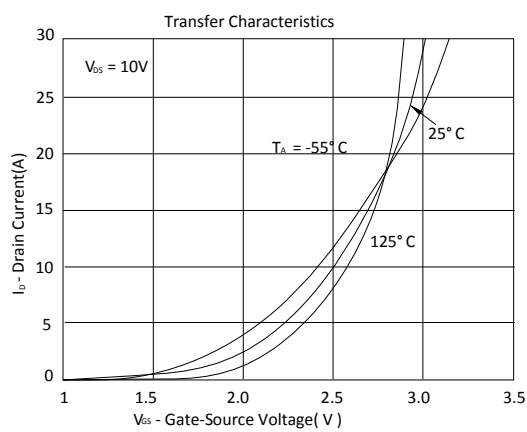
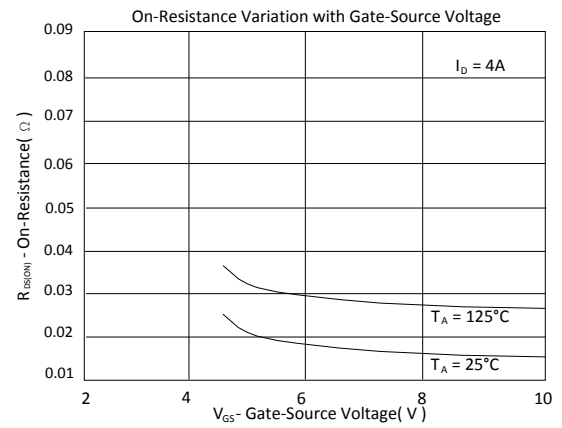
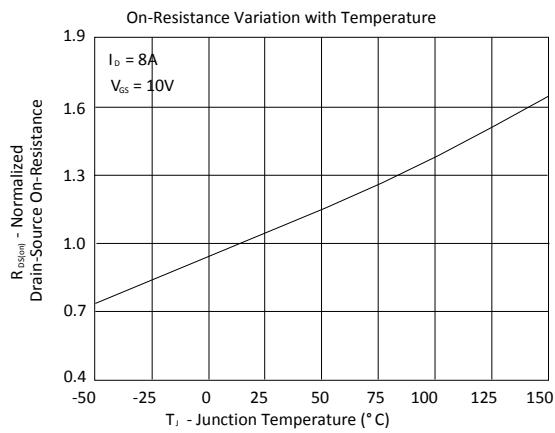
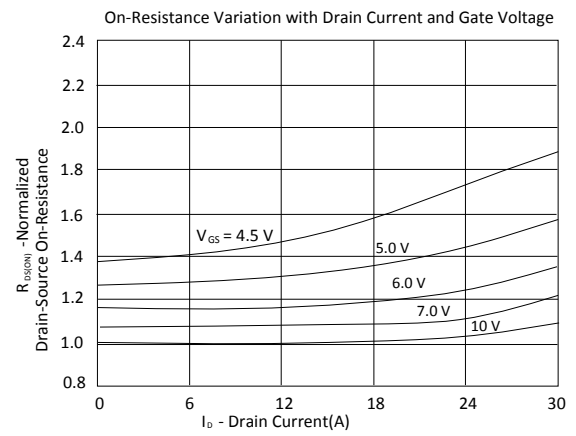
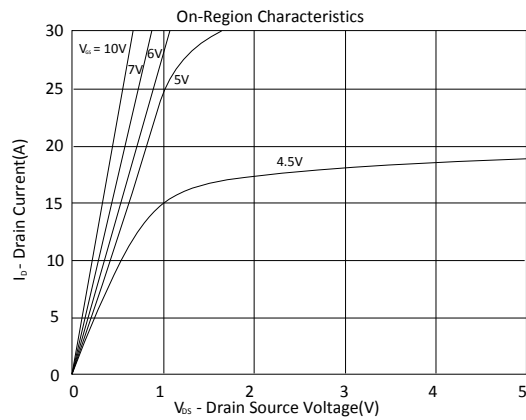
| Dimension | A    | A1   | B    | B1   | B2   | C    | D    | D2   | D3   | E    | E2   | H     | L    | L1   | L2   | L3   | P    |
|-----------|------|------|------|------|------|------|------|------|------|------|------|-------|------|------|------|------|------|
| Min.      | 2.10 | 1.10 | 0.30 | 0.55 | 0.40 | 0.40 | 5.30 | 6.70 | 2.20 | 6.30 | 4.80 | 9.20  | 1.30 | 0.90 | 0.50 | 0.00 | 1.17 |
| Max.      | 2.50 | 1.30 | 0.70 | 0.75 | 0.80 | 0.60 | 5.70 | 7.30 | 3.00 | 6.70 | 5.45 | 10.15 | 1.70 | 1.50 | 1.10 | 0.30 | 1.37 |

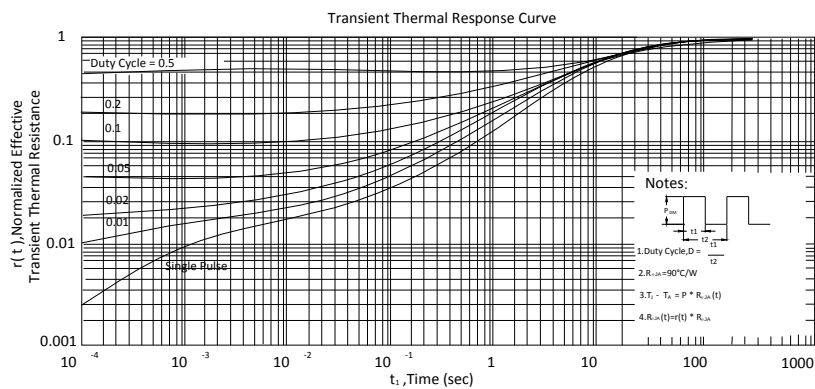
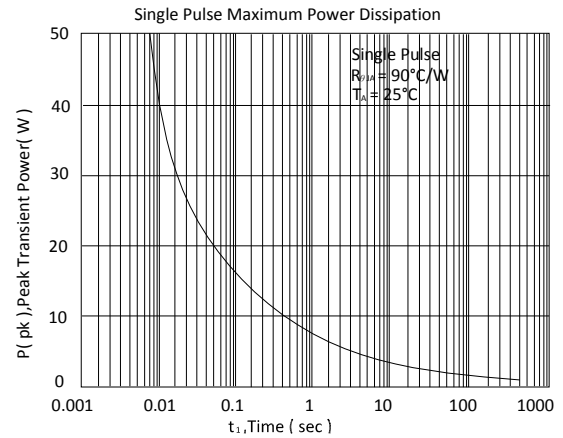
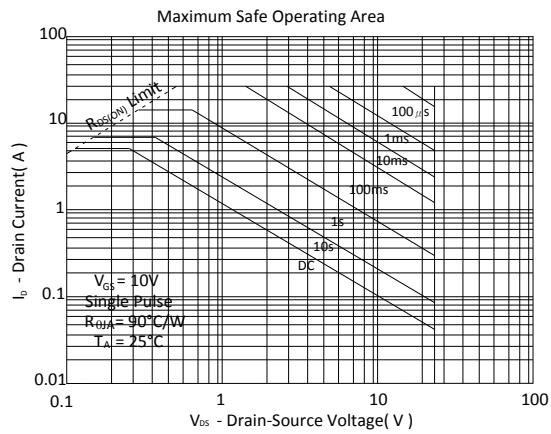
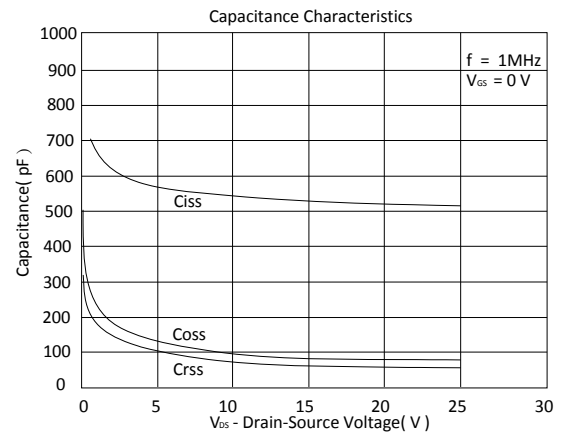
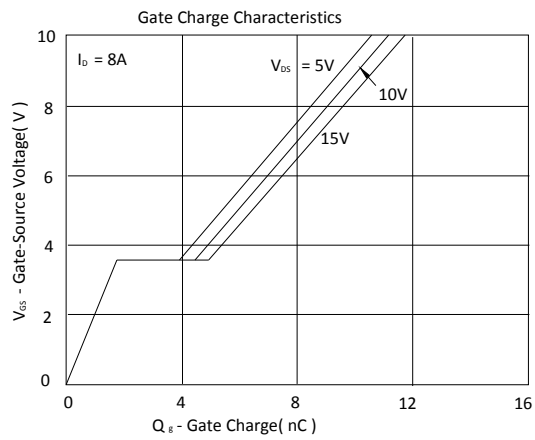
## Footprint





## N-Channel







P-Channel

