

## Features

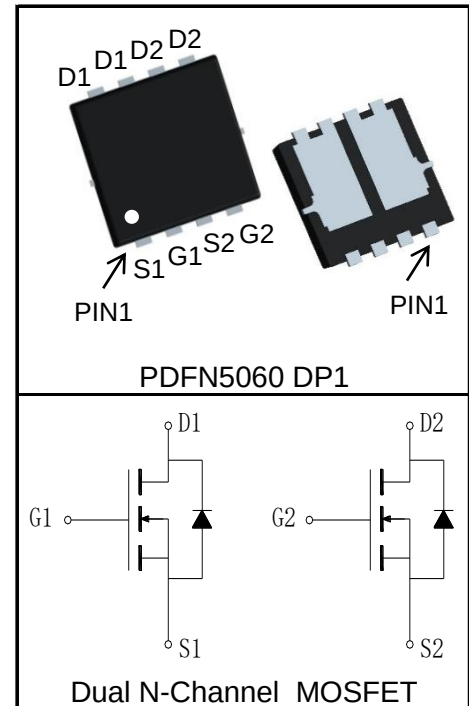
- 60V/35A,  
 $R_{DS(ON)} = 11m\Omega(Typ.)@V_{GS}=10V$   
 $R_{DS(ON)} = 13m\Omega(Typ.)@V_{GS}=4.5V$
- Excellent  $Q_G \times R_{DS(on)}$  product(FOM)
- SGT Technology
- Fast Switching Speed
- 100% avalanche tested

## Applications

- Switching Application Systems



## Pin Description



## Absolute Maximum Ratings

| Symbol                                                       | Parameter                                                                   |                       | Rating     | Unit |
|--------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------|------------|------|
| Common Ratings (T <sub>C</sub> =25°C Unless Otherwise Noted) |                                                                             |                       |            |      |
| V <sub>DSS</sub>                                             | Drain-Source Voltage                                                        |                       | 60         | V    |
| V <sub>GSS</sub>                                             | Gate-Source Voltage                                                         |                       | ±20        |      |
| T <sub>J</sub>                                               | Maximum Junction Temperature                                                |                       | 150        | °C   |
| T <sub>STG</sub>                                             | Storage Temperature Range                                                   |                       | -55 to 150 | °C   |
| I <sub>S</sub>                                               | Diode Continuous Forward Current                                            | T <sub>C</sub> =25°C  | 35         | A    |
| Mounted on Large Heat Sink                                   |                                                                             |                       |            |      |
| I <sub>DP</sub> <sup>①</sup>                                 | 300μs Pulse Drain Current Tested                                            | T <sub>C</sub> =25°C  | 140        | A    |
| I <sub>D</sub> <sup>②</sup>                                  | Continuous Drain Current@T <sub>C</sub> (V <sub>GS</sub> =10V)              | T <sub>C</sub> =25°C  | 35         | A    |
|                                                              |                                                                             | T <sub>C</sub> =100°C | 22         |      |
|                                                              | Continuous Drain Current@T <sub>A</sub> (V <sub>GS</sub> =10V) <sup>③</sup> | T <sub>A</sub> =25°C  | 12         |      |
|                                                              |                                                                             | T <sub>A</sub> =70°C  | 9          |      |
| P <sub>D</sub>                                               | Maximum Power Dissipation@T <sub>C</sub>                                    | T <sub>C</sub> =25°C  | 27         | W    |
|                                                              |                                                                             | T <sub>C</sub> =100°C | 11         |      |
|                                                              | Maximum Power Dissipation@T <sub>A</sub> <sup>③</sup>                       | T <sub>A</sub> =25°C  | 3.1        |      |
|                                                              |                                                                             | T <sub>A</sub> =70°C  | 2          |      |

| Symbol                                | Parameter                              | Rating | Unit                 |
|---------------------------------------|----------------------------------------|--------|----------------------|
| $R_{\theta JC}$                       | Thermal Resistance-Junction to Case    | 4.6    | $^{\circ}\text{C/W}$ |
| $R_{\theta JA}^{(3)}$                 | Thermal Resistance-Junction to Ambient | 40     | $^{\circ}\text{C/W}$ |
| <b>Drain-Source Avalanche Ratings</b> |                                        |        |                      |
| $E_{AS}^{(4)}$                        | Avalanche Energy, Single Pulsed        | 49     | mJ                   |

**Electrical Characteristics** ( $T_C=25^{\circ}\text{C}$  Unless Otherwise Noted)

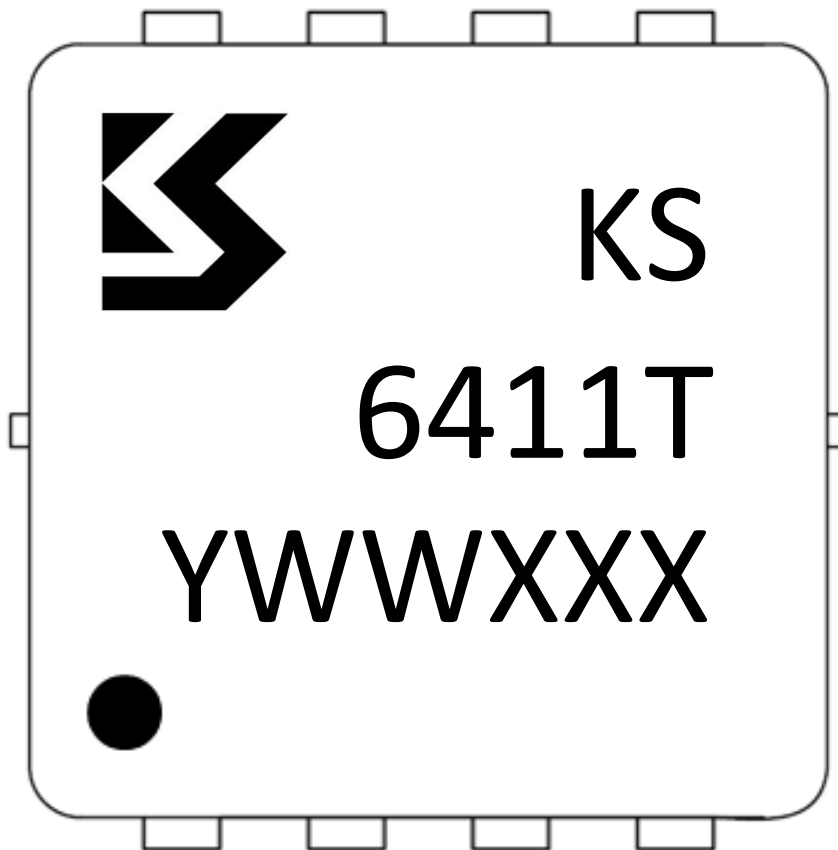
| Symbol                        | Parameter                        | Test Condition                                                                          | KS6411NAT             |      |      | Unit |
|-------------------------------|----------------------------------|-----------------------------------------------------------------------------------------|-----------------------|------|------|------|
|                               |                                  |                                                                                         | Min.                  | Typ. | Max. |      |
| Static Characteristics        |                                  |                                                                                         |                       |      |      |      |
| BV <sub>DSS</sub>             | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA                                             | 60                    |      |      | V    |
| I <sub>DSS</sub>              | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V                                               |                       |      | 1    | μA   |
|                               |                                  |                                                                                         | T <sub>J</sub> =125°C |      | 30   |      |
| V <sub>GS(th)</sub>           | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA                               | 1.1                   | 1.8  | 2.3  | V    |
| I <sub>GSS</sub>              | Gate Leakage Current             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                              |                       |      | ±100 | nA   |
| R <sub>DS(ON)</sub> ⑤         | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =15A                                              |                       | 11   | 14   | mΩ   |
|                               |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =10A                                             |                       | 13   | 20   | mΩ   |
| Diode Characteristics         |                                  |                                                                                         |                       |      |      |      |
| V <sub>SD</sub> ⑤             | Diode Forward Voltage            | I <sub>SD</sub> =15A, V <sub>GS</sub> =0V                                               |                       | 0.86 | 1.2  | V    |
| t <sub>rr</sub>               | Reverse Recovery Time            | I <sub>SD</sub> =15A, dI <sub>SD</sub> /dt=100A/μs                                      |                       | 21   |      | ns   |
| Q <sub>rr</sub>               | Reverse Recovery Charge          |                                                                                         |                       | 34   |      | nC   |
| Dynamic Characteristics ⑥     |                                  |                                                                                         |                       |      |      |      |
| R <sub>G</sub>                | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                        |                       | 1    |      | Ω    |
| C <sub>iss</sub>              | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =30V,<br>Frequency=1.0MHz                       |                       | 1360 |      | pF   |
| C <sub>oss</sub>              | Output Capacitance               |                                                                                         |                       | 515  |      |      |
| C <sub>rss</sub>              | Reverse Transfer Capacitance     |                                                                                         |                       | 30   |      |      |
| t <sub>d(ON)</sub>            | Turn-on Delay Time               | V <sub>DD</sub> =30V, I <sub>DS</sub> =15A,<br>V <sub>GS</sub> =10V, R <sub>G</sub> =6Ω |                       | 10   |      | ns   |
| t <sub>r</sub>                | Turn-on Rise Time                |                                                                                         |                       | 17   |      |      |
| t <sub>d(OFF)</sub>           | Turn-off Delay Time              |                                                                                         |                       | 32   |      |      |
| t <sub>f</sub>                | Turn-off Fall Time               |                                                                                         |                       | 12   |      |      |
| Gate Charge Characteristics ⑥ |                                  |                                                                                         |                       |      |      |      |
| Q <sub>g</sub>                | Total Gate Charge                | V <sub>DS</sub> =30V, V <sub>GS</sub> =10V,<br>I <sub>DS</sub> =15A                     |                       | 15   |      | nC   |
| Q <sub>gs</sub>               | Gate-Source Charge               |                                                                                         |                       | 4.7  |      |      |
| Q <sub>gd</sub>               | Gate-Drain Charge                |                                                                                         |                       | 3.6  |      |      |

**Notes:**

- ①Pulse width limited by safe operating area.
- ②Calculated continuous current based on maximum allowable junction temperature.
- ③When mounted on 1 inch square copper board,  $t \leq 10\text{sec}$ .
- ④Limited by  $T_{j\max}$ ,  $I_{AS} = 14\text{A}$ ,  $L = 0.5\text{mH}$ ,  $V_{DD} = 30\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_j = 25^\circ\text{C}$ .
- ⑤Pulse test;Pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- ⑥Guaranteed by design, not subject to production testing.

**Ordering and Marking Information**

| Device    | Package      | Packaging | Quantity | Reel Size | Tape width |
|-----------|--------------|-----------|----------|-----------|------------|
| KS6411NAT | PDFN5060 DP1 | Tape&Reel | 5000     | 13"       | 12mm       |

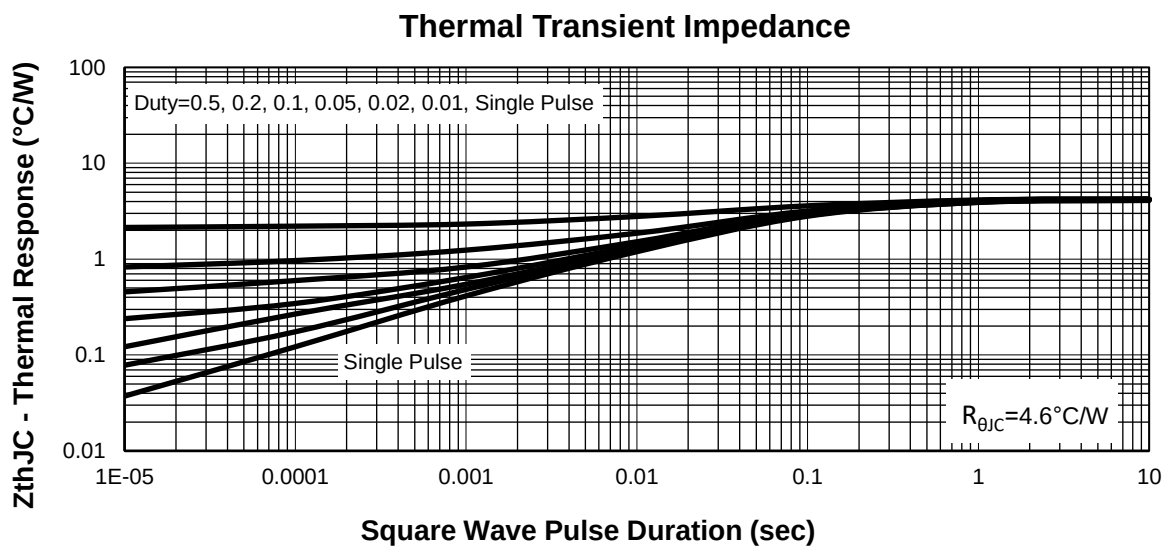
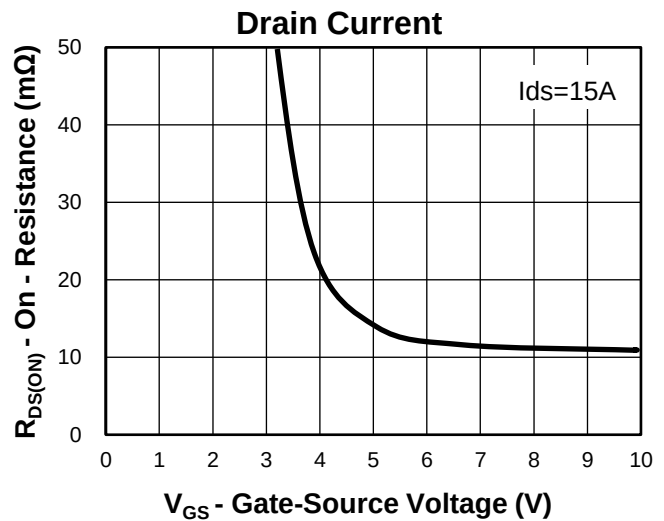
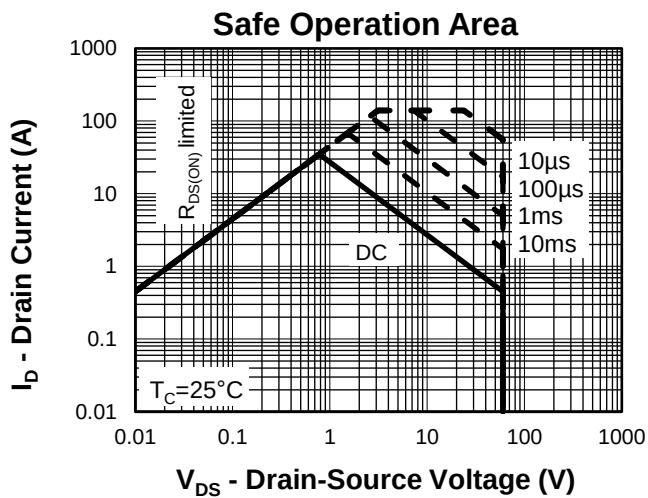
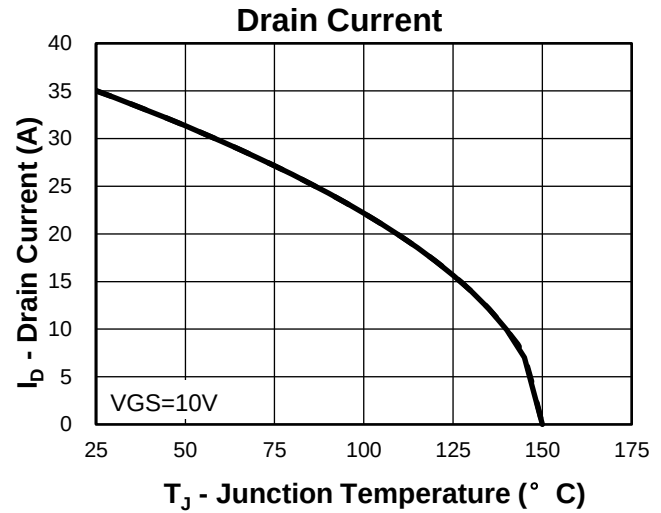
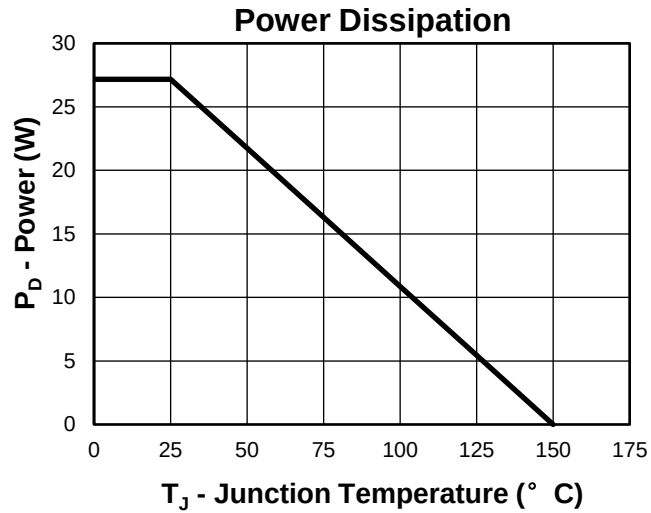


1st Line: Kwansemi LOGO, Kwansemi Code(KS)

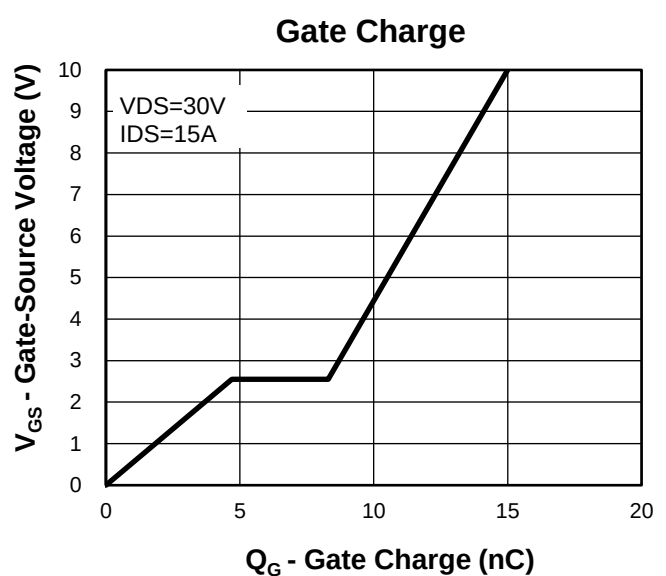
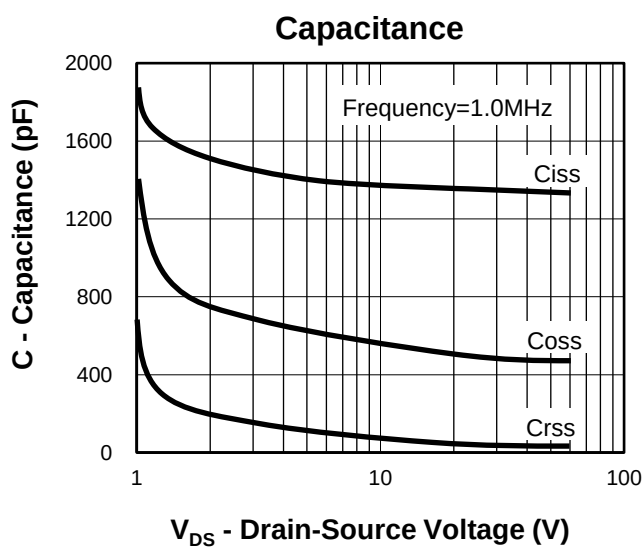
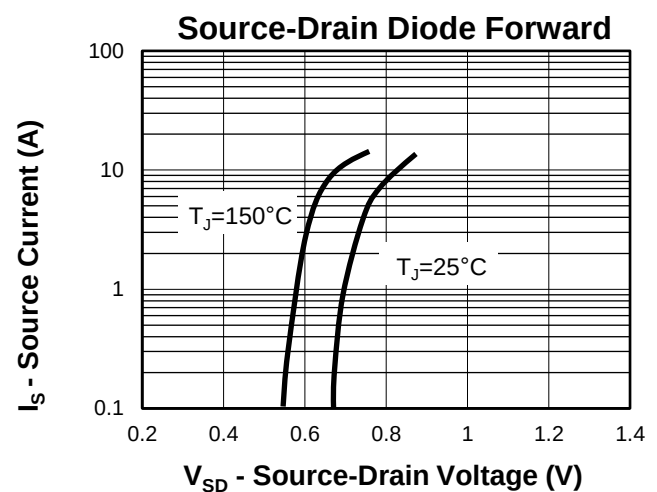
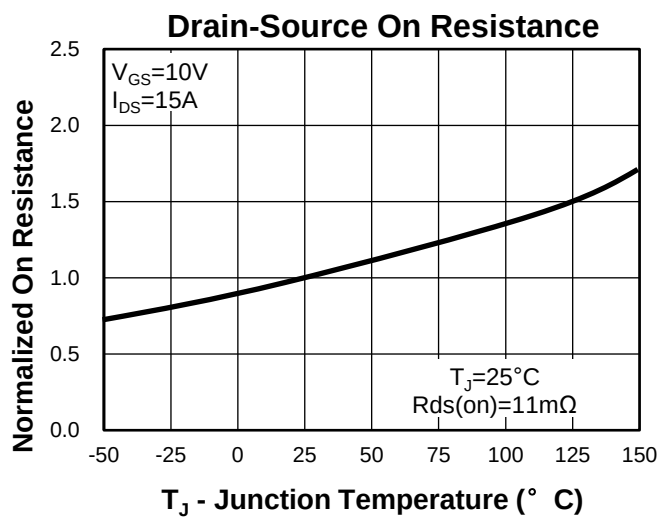
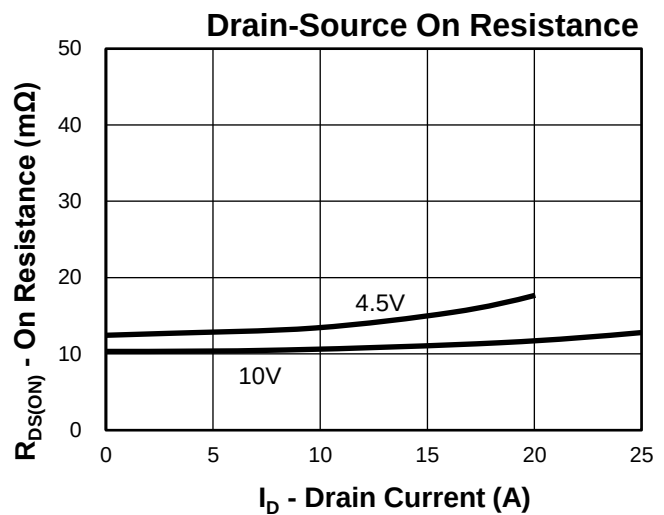
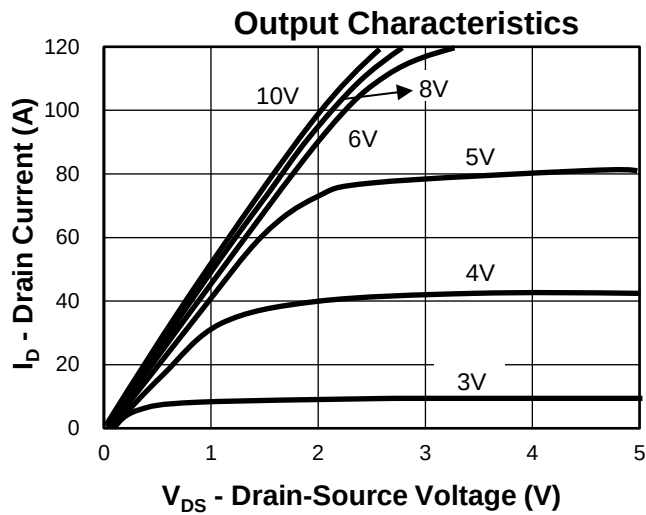
2nd Line: Part Number(6411T)

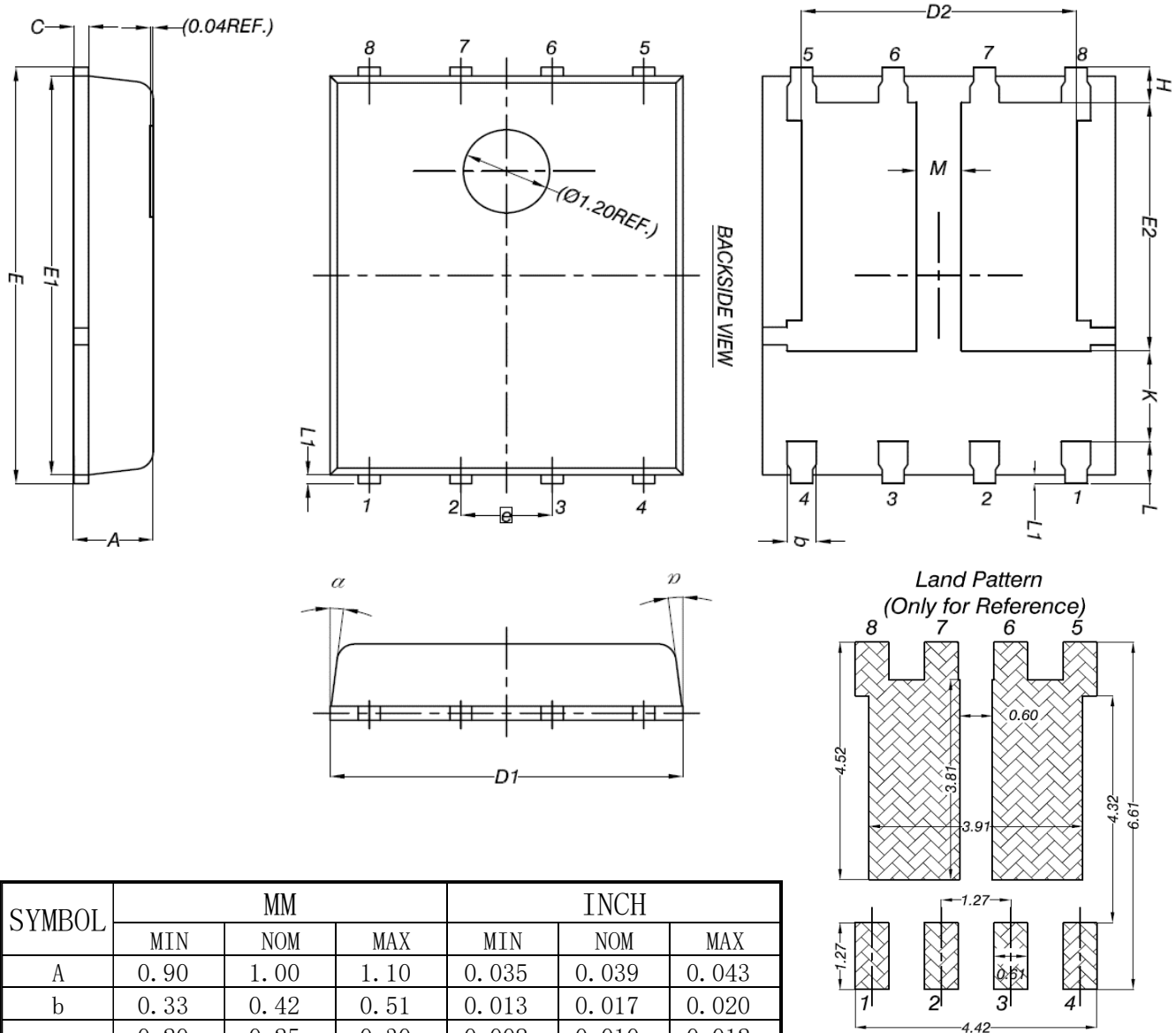
3rd Line: Lot Number(YWWXXX)

## Typical Characteristics



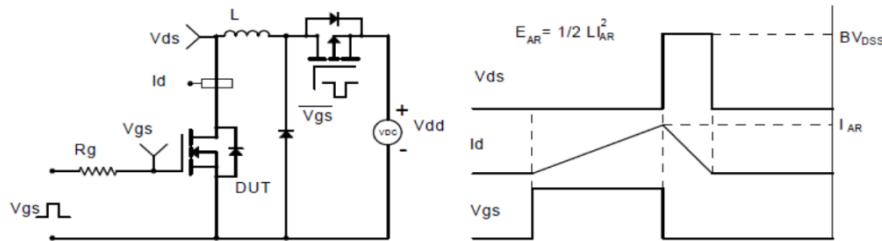
## Typical Characteristics



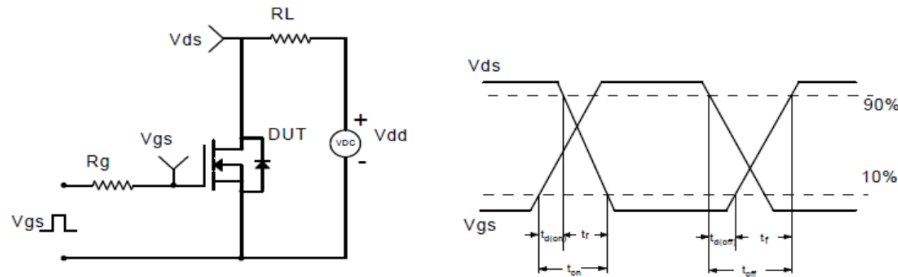
**Package Information**
**PDFN5060 DP1**


| SYMBOL | MM       |      |      | INCH      |       |       |
|--------|----------|------|------|-----------|-------|-------|
|        | MIN      | NOM  | MAX  | MIN       | NOM   | MAX   |
| A      | 0.90     | 1.00 | 1.10 | 0.035     | 0.039 | 0.043 |
| b      | 0.33     | 0.42 | 0.51 | 0.013     | 0.017 | 0.020 |
| c      | 0.20     | 0.25 | 0.30 | 0.008     | 0.010 | 0.012 |
| D1     | 4.80     | 4.90 | 5.00 | 0.189     | 0.193 | 0.197 |
| D2     | 3.61     | 3.79 | 3.96 | 0.142     | 0.149 | 0.156 |
| E      | 5.90     | 6.00 | 6.10 | 0.232     | 0.236 | 0.240 |
| E1     | 5.65     | 5.75 | 5.85 | 0.222     | 0.226 | 0.230 |
| E2     | 3.38     | 3.58 | 3.78 | 0.133     | 0.141 | 0.149 |
| e      | 1.27 BSC |      |      | 0.050 BSC |       |       |
| H      | 0.41     | 0.51 | 0.61 | 0.016     | 0.020 | 0.024 |
| k      | 1.10     |      |      | 0.043     |       |       |
| L      | 0.51     | 0.61 | 0.71 | 0.020     | 0.024 | 0.028 |
| L1     | 0.06     | 0.13 | 0.20 | 0.002     | 0.005 | 0.008 |
| M      | 0.50     |      |      | 0.020     |       |       |
| a      | 0°       |      | 12°  | 0°        |       | 12°   |

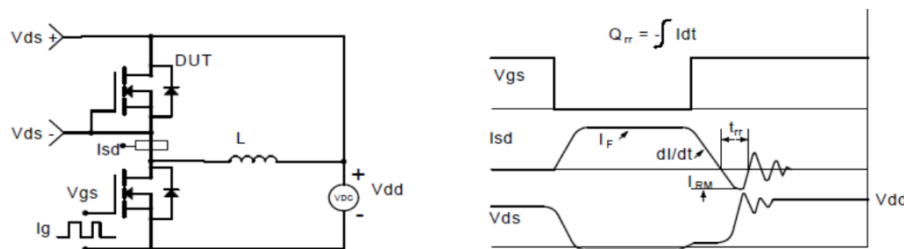
### Avalanche Test Circuit and Waveforms



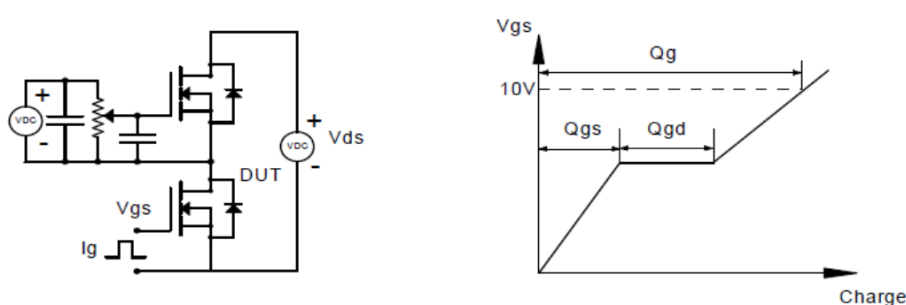
### Switching Time Test Circuit and Waveforms



### Diode Recovery Test Circuit and Waveforms



### Gate Charge Test Circuit and Waveform



### Customer Service

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