

## 650V N-Channel Super Junction MOSFET

|                |              |              |               |
|----------------|--------------|--------------|---------------|
| <b>Voltage</b> | <b>650 V</b> | <b>Rdson</b> | <b>210 mΩ</b> |
| <b>Current</b> | <b>19 A</b>  | <b>Qg</b>    | <b>34 nC</b>  |

### Feature:

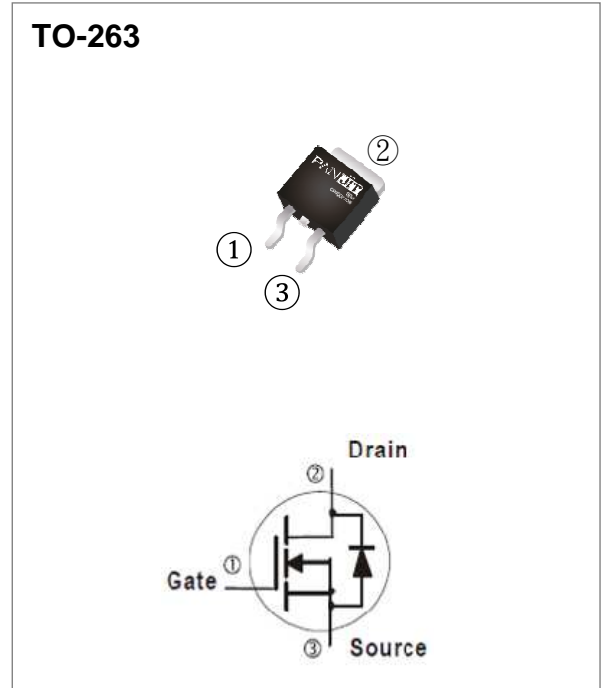
- $R_{DS(ON) Max, V_{GS}@10V}$ : 210mΩ
- Easy to use/ drive
- High Speed Switching and Low  $R_{DS(ON)}$
- 100% Avalanche Tested
- 100% Rg Tested
- Lead free in compliance with EU RoHS 2.0
- Green molding compound as per IEC 61249 standard

### Mechanical Data

- Case: TO-263 package
- Terminals: Solderable per MIL-STD-750, Method 2026
- Approx. Weight: 1.38 grams

### Application

- PFC, TV Power, PC Power, PD Charger, Adapter, UPS



## Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise specified)

| PARAMETER  |                         | SYMBOL         | LIMIT    | UNITS            |
|--|-------------------------|----------------|----------|------------------|
| Drain-Source Voltage @ $T_{jmax}$                |                         | $V_{DS}$       | 700      | V                |
| Drain-Source Voltage                             |                         | $V_{DS}$       | 650      |                  |
| Gate-Source Voltage                              |                         | $V_{GS}$       | $\pm 30$ |                  |
| Continuous Drain Current                         | $T_C=25^\circ\text{C}$  | $I_D$          | 19.0     | A                |
|  | $T_C=100^\circ\text{C}$ |                | 11.2     |                  |
| Pulsed Drain Current                             | $T_C=25^\circ\text{C}$  | $I_{DM}$       | 42       | A                |
| Single Pulse Avalanche Energy                    |                         | $E_{AS}$       | 420      | mJ               |
| MOSFET dv/dt ruggedness                          |                         | dv/dt          | 50       | V/ns             |
| Power Dissipation                                | $T_C=25^\circ\text{C}$  | $P_D$          | 150      | W                |
|  | $T_C=100^\circ\text{C}$ |                | 60       |                  |
| Operating Junction and Storage Temperature Range |                         | $T_J, T_{STG}$ | -55~150  | $^\circ\text{C}$ |

### Thermal Characteristics

| PARAMETER          |                              | SYMBOL          | MAXIMUM | UNITS              |
|--------------------|------------------------------|-----------------|---------|--------------------|
| Thermal Resistance | Junction-to-Case             | $R_{\theta JC}$ | 0.83    | $^\circ\text{C/W}$ |
|                    | Junction-to-Ambient (Note 3) | $R_{\theta JA}$ | 62.5    | $^\circ\text{C/W}$ |

## Electrical Characteristics (T<sub>A</sub> = 25 °C unless otherwise specified)

| PARAMETER  | SYMBOL              | TEST CONDITION  | MIN.   | TYP. | MAX. | UNITS |
|--|---------------------|---|--|------|------|-------|
| <b>Static</b>  |                     |   |  |      |      |       |
| Drain-Source Breakdown Voltage                           | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA  | 650  | 730  | -    | V     |
| Gate Threshold Voltage                                   | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA  | 2  | 3.0  | 4    |       |
| Drain-Source On-State Resistance                         | R <sub>DS(on)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =9.5A <sup>(Note 1)</sup>  | -  | 183  | 210  | mΩ    |
| Zero Gate Voltage Drain Current                          | I <sub>DSS</sub>    | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V  | -  | -    | 1    | uA    |
| Gate-Source Leakage Current                              | I <sub>GSS</sub>    | V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V  | -  | -    | ±100 | nA    |
| Transfer characteristics                                 | gfs                 | V <sub>DS</sub> =20V, I <sub>D</sub> =19A   | -  | 21.8 | -    | S     |
| <b>Dynamic</b> <sup>(Note 5)</sup>                       |                     |   |  |      |      |       |
| Total Gate Charge  | Q <sub>g</sub>      | V <sub>DS</sub> =520V, I <sub>D</sub> =19A,<br>V <sub>GS</sub> =10V   | -  | 34   | -    | nC    |
| Gate-Source Charge                                       | Q <sub>gs</sub>     |   | -  | 7.7  | -    |       |
| Gate-Drain Charge  | Q <sub>gd</sub>     |   | -  | 13.5 | -    |       |
| Input Capacitance  | C <sub>iss</sub>    | V <sub>DS</sub> =400V, V <sub>GS</sub> =0V,<br>f=250kHz   | -  | 1412 | -    | pF    |
| Output Capacitance                                       | C <sub>oss</sub>    |   | -  | 50   | -    |       |
| Reverse Transfer Capacitance                             | C <sub>rss</sub>    |   | -  | 6.8  | -    |       |
| Effective Output Capacitance<br>Energy Related           | C <sub>o(er)</sub>  |   | V <sub>DS</sub> =0V to 400V,<br>V <sub>GS</sub> =0V, f=250kHz<br><sup>(Note 4)</sup> | -    | 64   |       |
| Turn-On Delay Time                                       | t <sub>d(on)</sub>  | V <sub>DD</sub> =325V, I <sub>D</sub> =19A,<br>V <sub>GS</sub> =10V, R <sub>G</sub> =25Ω<br><sup>(Note 2)</sup> | -  | 30   | -    | ns    |
| Turn-On Rise Time  | t <sub>r</sub>      |   | -  | 65   | -    |       |
| Turn-Off Delay Time                                      | t <sub>d(off)</sub> |   | -  | 111  | -    |       |
| Turn-Off Fall Time                                       | t <sub>f</sub>      |   | -  | 61   | -    |       |
| Gate Resistance  | R <sub>g</sub>      | f=1.0MHz  | -  | 1.7  | -    | Ω     |
| <b>Drain-Source Diode</b>                                |                     |   |  |      |      |       |
| Maximum Continuous Drain-Source<br>Diode Forward Current | I <sub>s</sub>      |   | -  | -    | 19   | A     |
| Diode Forward Voltage                                    | V <sub>SD</sub>     | I <sub>s</sub> =19A, V <sub>GS</sub> =0V  | -  | 0.9  | 1.5  | V     |
| Reverse Recovery Charge                                  | Q <sub>rr</sub>     | I <sub>s</sub> =19A   | -  | 5.7  | -    | μC    |
| Reverse Recovery Time                                    | T <sub>rr</sub>     | di/dt=100A/μs   | -  | 370  | -    | ns    |

### NOTES :

1. Pulse width ≤ 300us, Duty cycle ≤ 2%
2. Essentially independent of operating temperature typical characteristics.
3. R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance.
4. C<sub>o(er)</sub> is a capacitance that gives the same stored energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0V to 80% V<sub>(BR)DSS</sub>
5. Guaranteed by design, not subject to production testing

TYPICAL CHARACTERISTIC CURVES

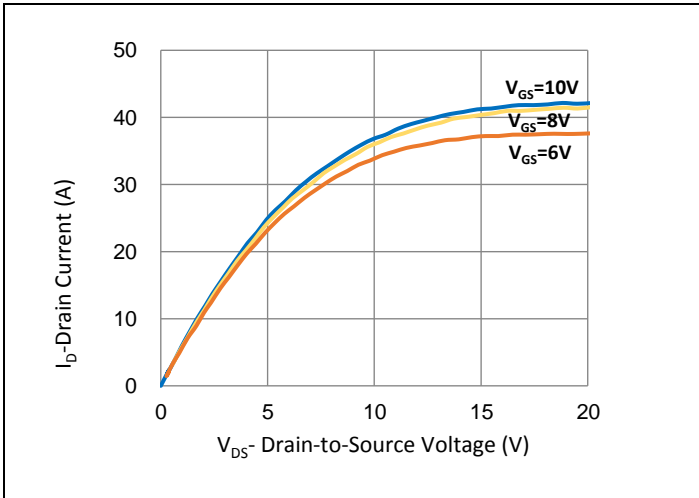


Fig.1 Output Characteristics

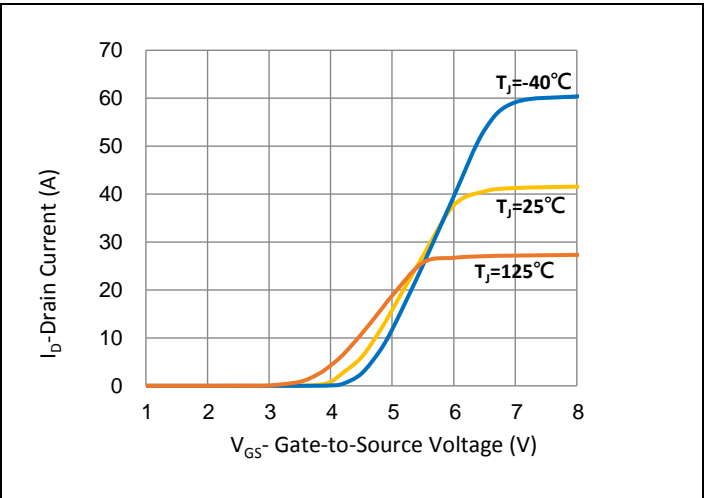


Fig.2 Transfer Characteristics

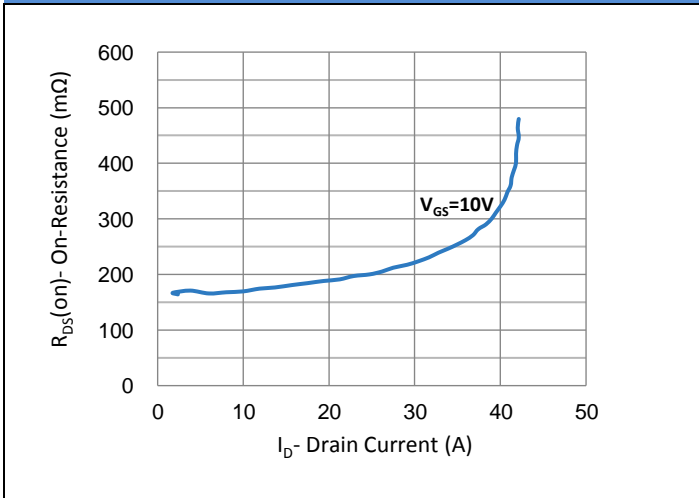


Fig.3 On-Resistance vs. Drain Current

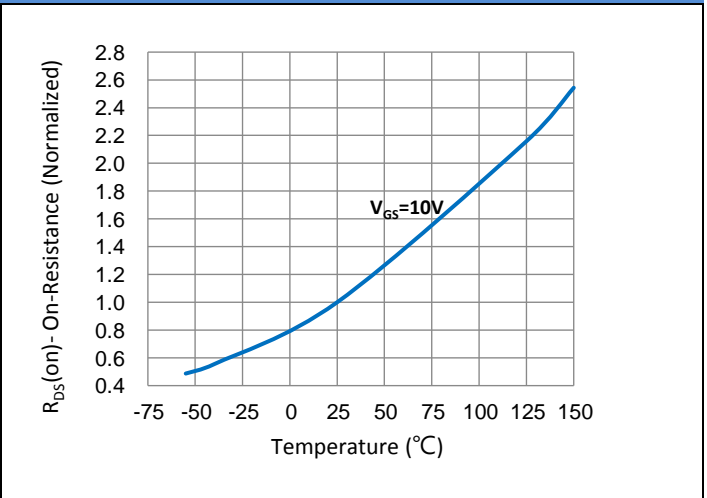


Fig.4 On-Resistance vs. Junction Temperature

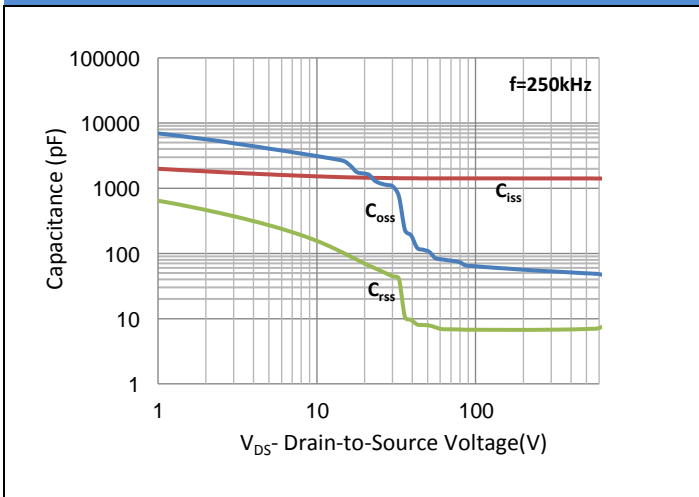


Fig.5 Capacitance vs. Drain-Source Voltage

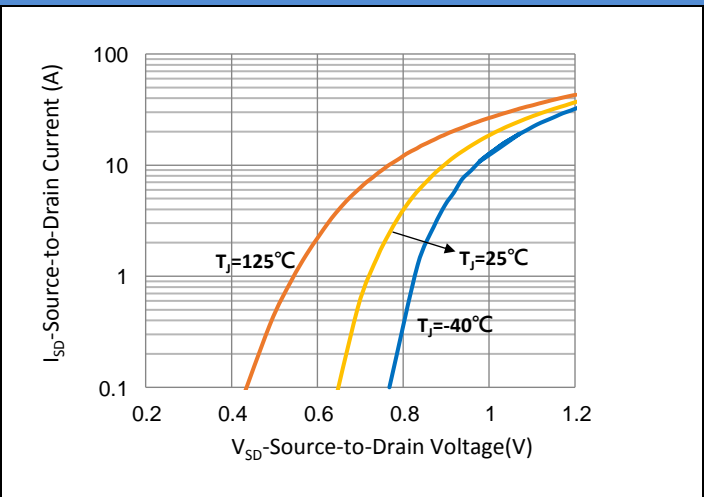


Fig.6 Source-Drain Diode Forward Voltage

TYPICAL CHARACTERISTIC CURVES

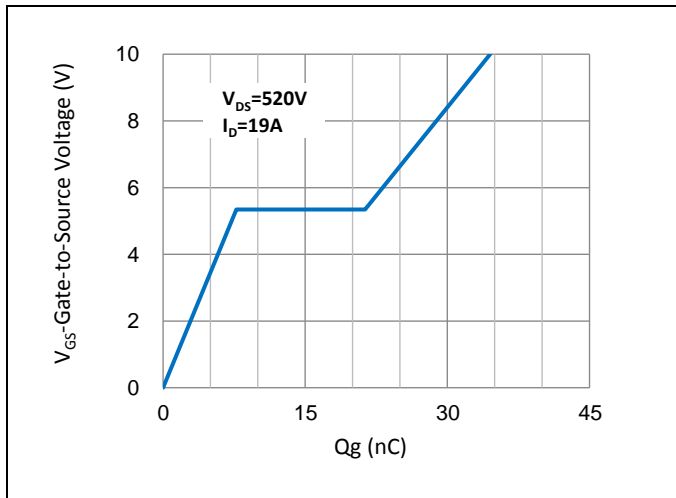


Fig.7 Gate-Charge Characteristics

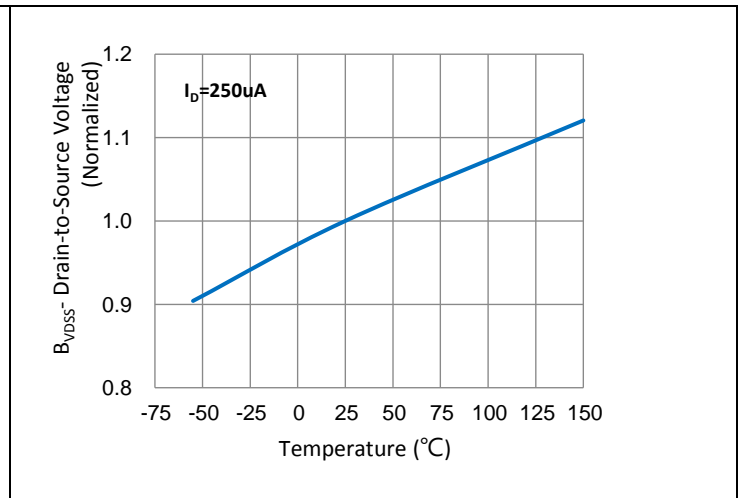


Fig.8 Breakdown Voltage Variation vs. Temperature

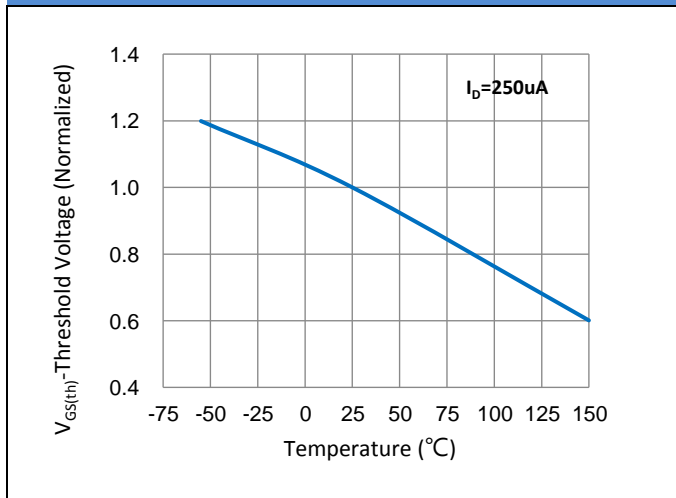


Fig.9 Threshold Voltage Variation with Temperature

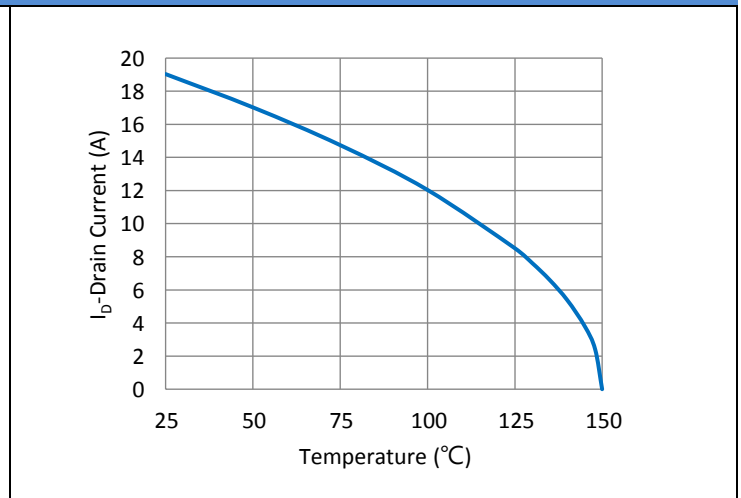


Fig.10 Drain Current vs. Case Temperature

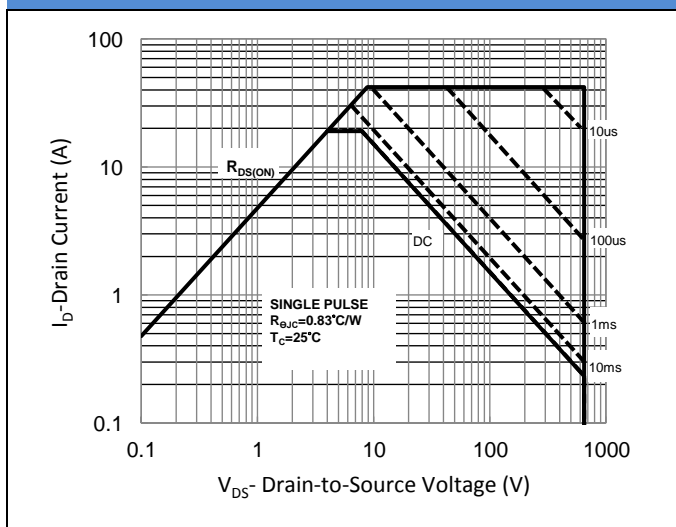


Fig.11 Maximum Safe Operating Area

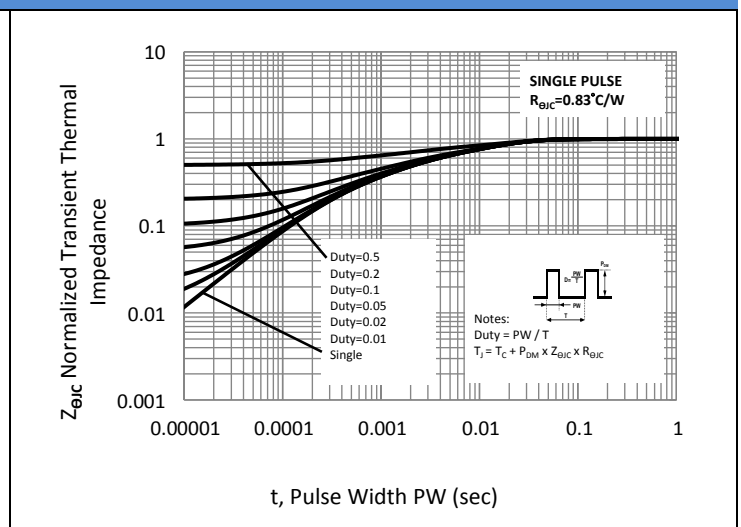


Fig.12 Normalized Transient Thermal Impedance

TYPICAL CHARACTERISTIC CURVES

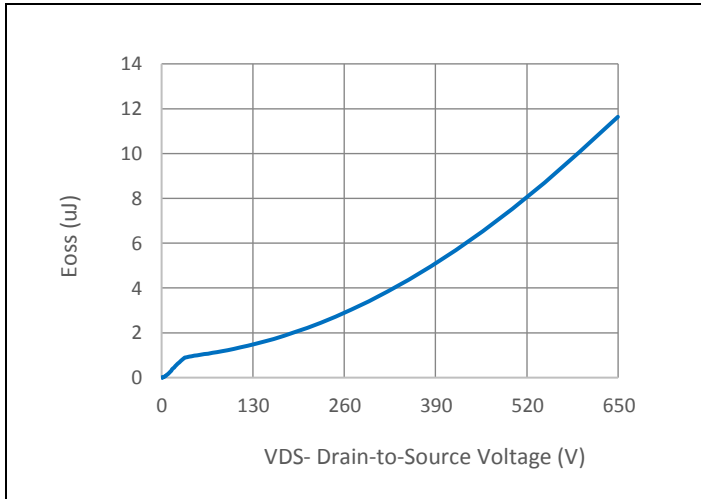
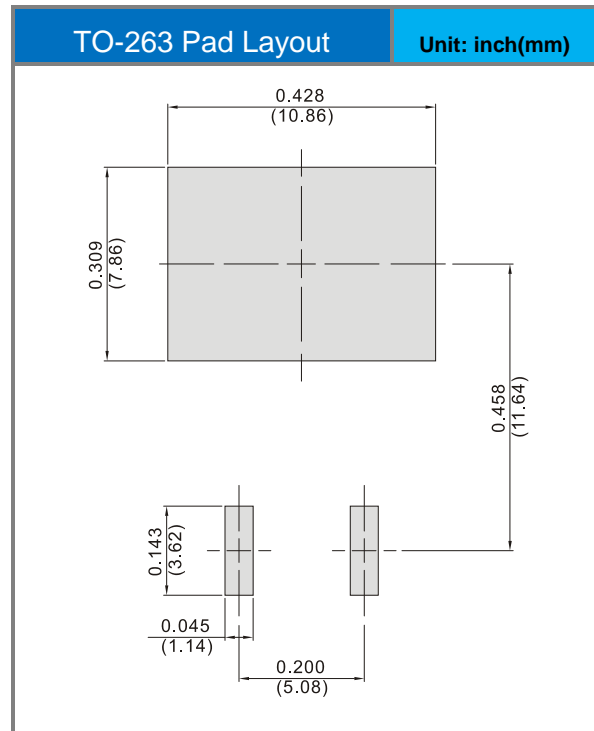
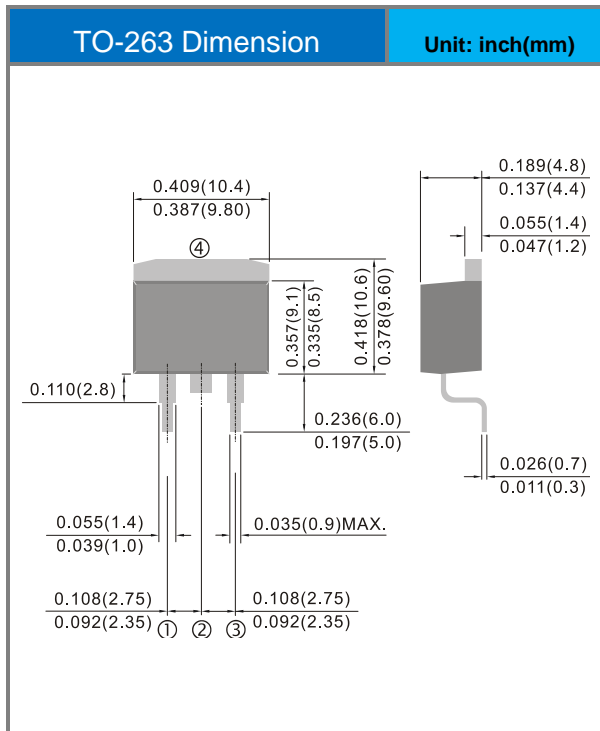


Fig.13 Typ. Coss Stored Energy

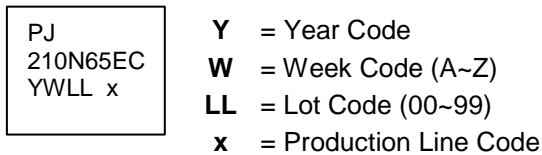
**Product and Packing Information**

| Part No.     | Package Type | Packing Type                  | Marking  |
|--------------|--------------|-------------------------------|----------|
| PJMB210N65EC | TO-263       | 50pcs / Tube<br>800pcs / Reel | 210N65EC |

**Packaging Information**



**Marking Diagram**



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[1.5SMCJ36CA\\_R1\\_00001](#) [1.5SMCJ40A\\_R1\\_00001](#) [1.5SMCJ48A\\_R1\\_00001](#) [1.5SMCJ51CAS](#) [1.5SMCJ54A\\_R1\\_00001](#)  
[1.5SMCJ75CA\\_R1\\_00001](#) [1N4007\\_AY\\_10001](#) [1N4007G\\_AY\\_00101](#) [1N4007G\\_AY\\_10001](#) [1N4148-34\\_R2\\_10001](#) [1N4148-35\\_AX\\_10001](#)  
[1N4148-35\\_AY\\_10001](#) [1N4148W-AU\\_R1\\_00001](#) [1N4148W-AU\\_R1\\_000A1](#) [1N4148W\\_R1\\_00001](#) [1N4148W\\_R1\\_000A7](#)  
[1N4148W\\_R1\\_000Z8](#) [1N4148W\\_R1\\_00101](#) [1N4148W\\_R2\\_00001](#) [1N4148WS](#) [1N4148WS-AU\\_R1\\_00001](#) [1N4148WS-AU\\_R1\\_000A1](#)  
[1N4148WS\\_R1\\_00001](#) [1N4148WS-R1\\_000A4](#) [1N4148WS\\_R1\\_00101](#) [1N4448W\\_R1\\_00001](#)