

**40V 0.83mΩ N-Ch Power MOSFET****Features**

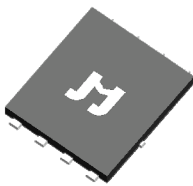
- Ultra-low ON-resistance,  $R_{DS(ON)}$
- Low Gate Charge,  $Q_g$
- 100% UIS and  $R_g$  Tested
- Pb-free Lead Plating
- Halogen-free and RoHS-compliant
- AEC-Q101 Qualified for Automotive Applications

**Product Summary**

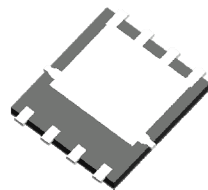
| Parameter                                | Value | Unit |
|------------------------------------------|-------|------|
| $V_{DS}$                                 | 40    | V    |
| $V_{GS(th)}_{Typ}$                       | 1.5   | V    |
| $I_D$ (@ $V_{GS} = 10V$ ) <sup>(1)</sup> | 299   | A    |
| $R_{DS(ON)}_{Typ}$ (@ $V_{GS} = 10V$ )   | 0.83  | mΩ   |
| $R_{DS(ON)}_{Typ}$ (@ $V_{GS} = 4.5V$ )  | 1.2   | mΩ   |

PDFN5x6-8L

Top View

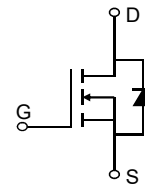
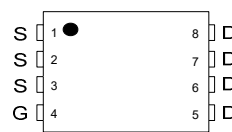


Bottom View



Pin Configuration

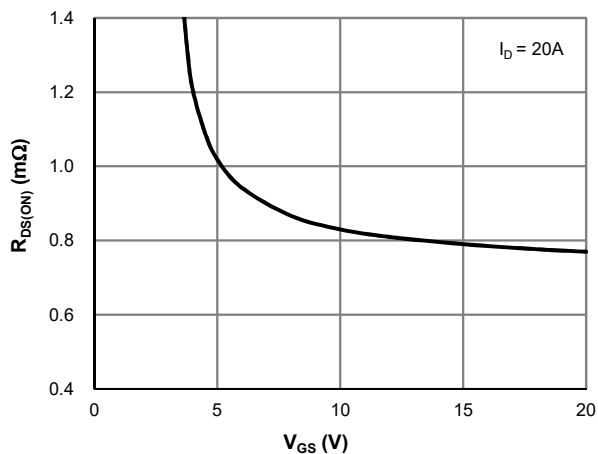
Top View

**Ordering Information**

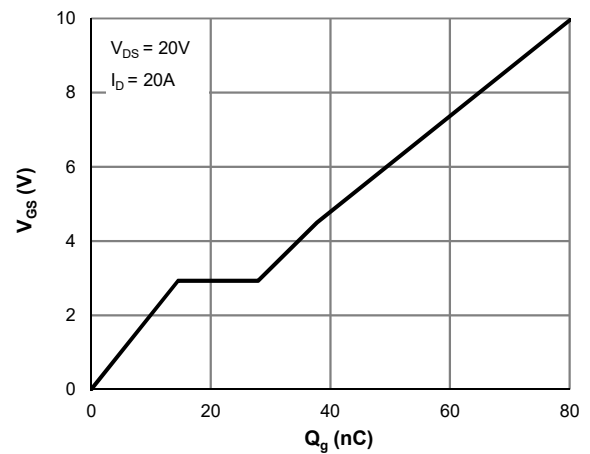
| Device         | Package    | # of Pins | Marking  | MSL | $T_J$ (°C) | Media        | Quantity (pcs) |
|----------------|------------|-----------|----------|-----|------------|--------------|----------------|
| JMSL0401BGQ-13 | PDFN5x6-8L | 8         | SL0401BQ | 1   | -55 to 175 | 13-inch Reel | 3000           |

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

| Parameter                               | Symbol                    | Value      | Unit |
|-----------------------------------------|---------------------------|------------|------|
| Drain-to-Source Voltage                 | $V_{DS}$                  | 40         | V    |
| Gate-to-Source Voltage                  | $V_{GS}$                  | $\pm 20$   | V    |
| Continuous Drain Current <sup>(1)</sup> | $T_C = 25^\circ\text{C}$  | $I_D$      | 299  |
|                                         | $T_C = 100^\circ\text{C}$ |            | 212  |
| Pulsed Drain Current <sup>(2)</sup>     | $I_{DM}$                  | 1197       | A    |
| Avalanche Energy <sup>(3)</sup>         | $E_{AS}$                  | 726        | mJ   |
| Power Dissipation <sup>(4)</sup>        | $T_C = 25^\circ\text{C}$  | $P_D$      | 176  |
|                                         | $T_C = 100^\circ\text{C}$ |            | 88   |
| Junction & Storage Temperature Range    | $T_J, T_{STG}$            | -55 to 175 | °C   |

 $R_{DS(ON)}$  vs.  $V_{GS}$ 

Gate Charge



**Electrical Characteristics** (@  $T_J = 25^\circ\text{C}$  unless otherwise specified)

| Parameter                         | Symbol        | Conditions                                                               | Min. | Typ. | Max.       | Unit             |
|-----------------------------------|---------------|--------------------------------------------------------------------------|------|------|------------|------------------|
| <b>STATIC PARAMETERS</b>          |               |                                                                          |      |      |            |                  |
| Drain-Source Breakdown Voltage    | $V_{(BR)DSS}$ | $I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$                            | 40   |      |            | V                |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{DS} = 32\text{V}$ , $V_{GS} = 0\text{V}$<br>$T_J = 55^\circ\text{C}$ |      |      | 1.0<br>5.0 | $\mu\text{A}$    |
| Gate-Body Leakage Current         | $I_{GSS}$     | $V_{DS} = 0\text{V}$ , $V_{GS} = \pm 20\text{V}$                         |      |      | $\pm 100$  | nA               |
| Gate Threshold Voltage            | $V_{GS(th)}$  | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$                               | 1.2  | 1.5  | 2.5        | V                |
| Static Drain-Source ON-Resistance | $R_{DS(ON)}$  | $V_{GS} = 10\text{V}$ , $I_D = 20\text{A}$                               |      | 0.83 | 0.98       | $\text{m}\Omega$ |
|                                   |               | $V_{GS} = 4.5\text{V}$ , $I_D = 15\text{A}$                              |      | 1.2  | 1.6        | $\text{m}\Omega$ |
| Forward Transconductance          | $g_{FS}$      | $V_{DS} = 5\text{V}$ , $I_D = 20\text{A}$                                |      | 118  |            | S                |
| Diode Forward Voltage             | $V_{SD}$      | $I_S = 1\text{A}$ , $V_{GS} = 0\text{V}$                                 |      | 0.65 | 1.0        | V                |
| Diode Continuous Current          | $I_S$         | $T_C = 25^\circ\text{C}$                                                 |      |      | 176        | A                |

**DYNAMIC PARAMETERS** <sup>(5)</sup>

|                              |           |                                                                  |  |      |  |          |
|------------------------------|-----------|------------------------------------------------------------------|--|------|--|----------|
| Input Capacitance            | $C_{iss}$ | $V_{GS} = 0\text{V}$ , $V_{DS} = 20\text{V}$ , $f = 1\text{MHz}$ |  | 5495 |  | pF       |
| Output Capacitance           | $C_{oss}$ |                                                                  |  | 3347 |  | pF       |
| Reverse Transfer Capacitance | $C_{rss}$ |                                                                  |  | 44   |  | pF       |
| Gate Resistance              | $R_g$     | $V_{GS} = 0\text{V}$ , $V_{DS} = 0\text{V}$ , $f = 1\text{MHz}$  |  | 2.1  |  | $\Omega$ |

**SWITCHING PARAMETERS** <sup>(5)</sup>

|                                               |              |                                                                                          |  |      |  |    |
|-----------------------------------------------|--------------|------------------------------------------------------------------------------------------|--|------|--|----|
| Total Gate Charge (@ $V_{GS} = 10\text{V}$ )  | $Q_g$        | $V_{GS} = 0$ to $10\text{V}$<br>$V_{DS} = 20\text{V}$ , $I_D = 20\text{A}$               |  | 80   |  | nC |
| Total Gate Charge (@ $V_{GS} = 4.5\text{V}$ ) | $Q_g$        |                                                                                          |  | 38   |  | nC |
| Gate Source Charge                            | $Q_{gs}$     |                                                                                          |  | 14.5 |  | nC |
| Gate Drain Charge                             | $Q_{gd}$     |                                                                                          |  | 13.4 |  | nC |
| Turn-On DelayTime                             | $t_{D(on)}$  | $V_{GS} = 10\text{V}$ , $V_{DS} = 20\text{V}$<br>$R_L = 1.0\Omega$ , $R_{GEN} = 6\Omega$ |  | 16.6 |  | ns |
| Turn-On Rise Time                             | $t_r$        |                                                                                          |  | 67   |  | ns |
| Turn-Off DelayTime                            | $t_{D(off)}$ |                                                                                          |  | 109  |  | ns |
| Turn-Off Fall Time                            | $t_f$        |                                                                                          |  | 114  |  | ns |
| Body Diode Reverse Recovery Time              | $t_{rr}$     | $I_F = 20\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$                                 |  | 72   |  | ns |
| Body Diode Reverse Recovery Charge            | $Q_{rr}$     | $I_F = 20\text{A}$ , $dI_F/dt = 100\text{A}/\mu\text{s}$                                 |  | 89   |  | nC |

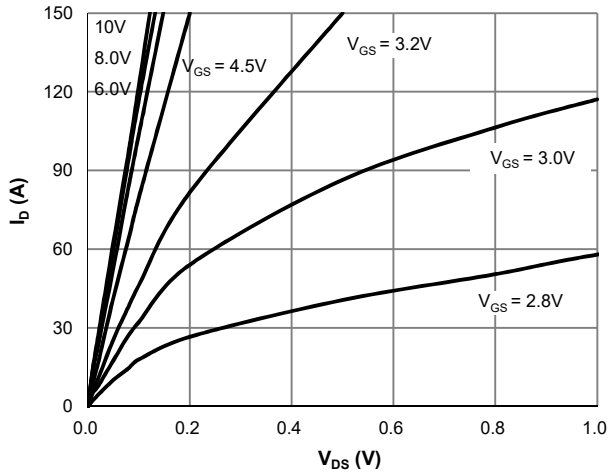
**Thermal Performance**

| Parameter                               | Symbol          | Typ. | Max. | Unit                      |
|-----------------------------------------|-----------------|------|------|---------------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 42   | 50   | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 0.85 | 0.98 | $^\circ\text{C}/\text{W}$ |

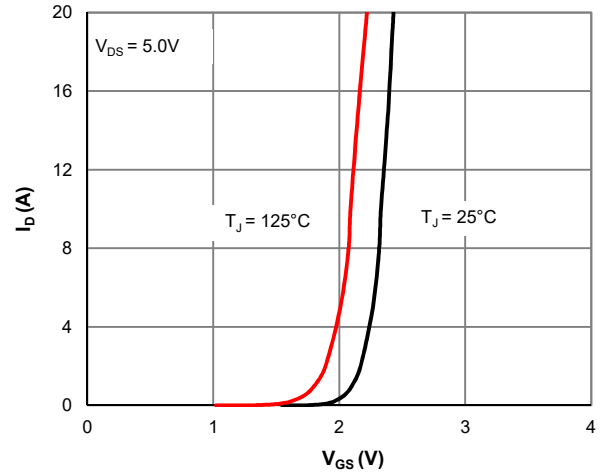
**Notes:**

1. Computed continuous current assumes the condition of  $T_{J\_Max}$  while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under  $T_{J\_Max} = 175^\circ\text{C}$ .
3.  $E_{AS}$  of 726 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 3.0\text{mH}$ ,  $I_{AS} = 22\text{A}$ ,  $V_{GS} = 10\text{V}$ ,  $V_{DD} = 20\text{V}$ ; 100% test at  $L = 0.3\text{mH}$ ,  $I_{AS} = 46\text{A}$ .
4. The power dissipation  $P_D$  is based on  $T_{J\_Max} = 175^\circ\text{C}$ .
5. This value is guaranteed by design hence it is not included in the production test.

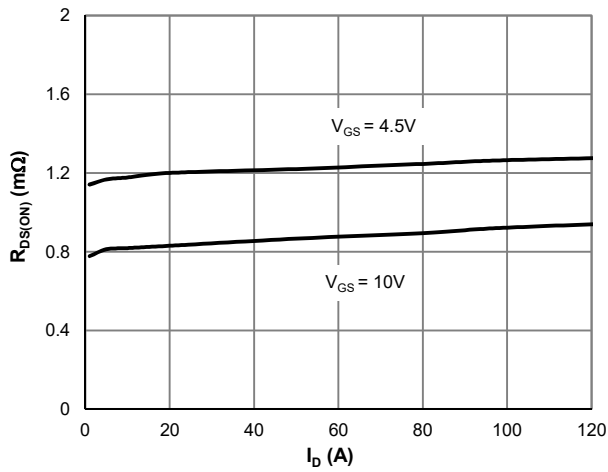
### Typical Electrical & Thermal Characteristics



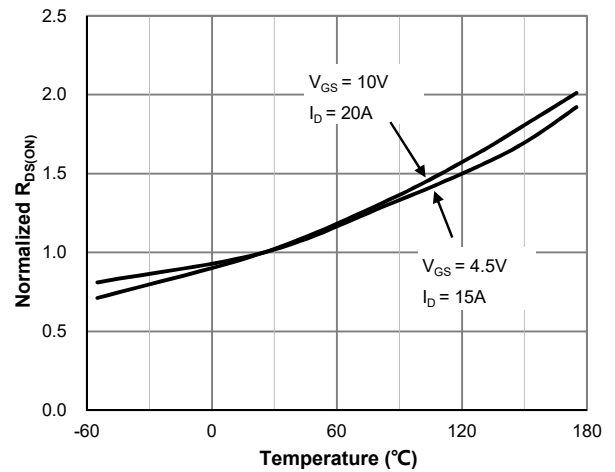
**Figure 1: Saturation Characteristics**



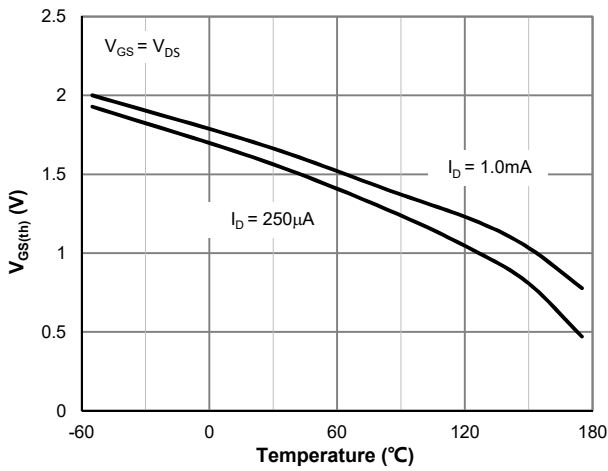
**Figure 2: Transfer Characteristics**



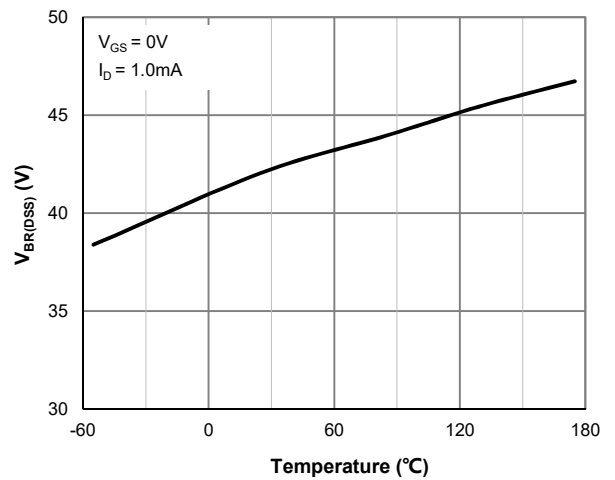
**Figure 3:  $R_{DS(ON)}$  vs. Drain Current**



**Figure 4:  $R_{DS(ON)}$  vs. Junction Temperature**

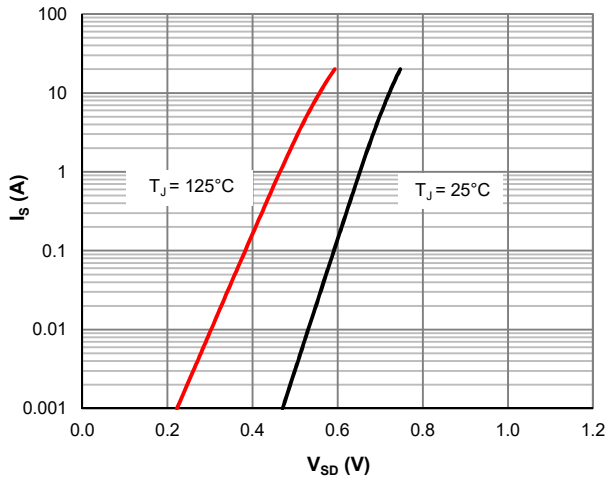


**Figure 5:  $V_{GS(th)}$  vs. Junction Temperature**

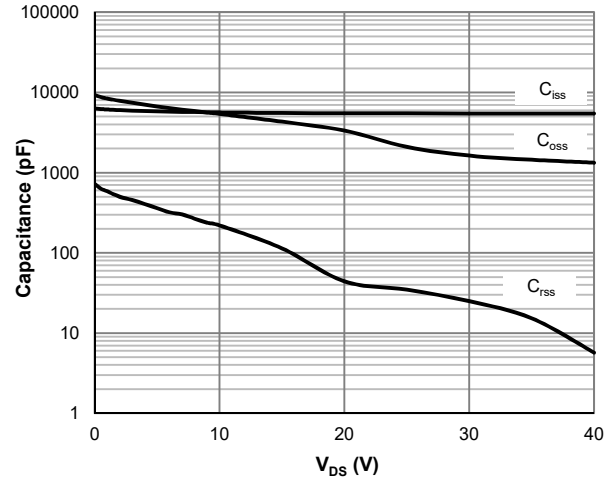


**Figure 6:  $V_{BR(DSS)}$  vs. Junction Temperature**

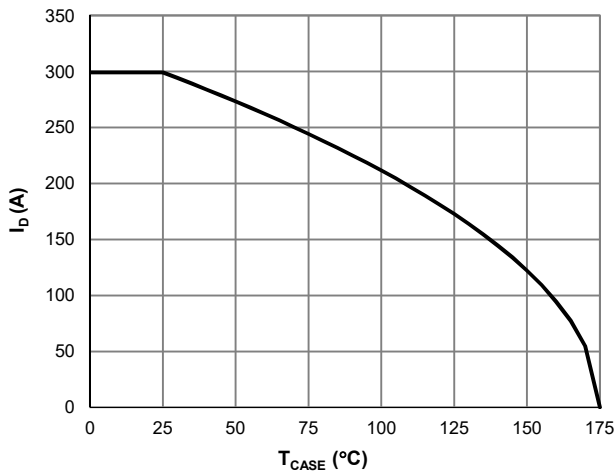
### Typical Electrical & Thermal Characteristics



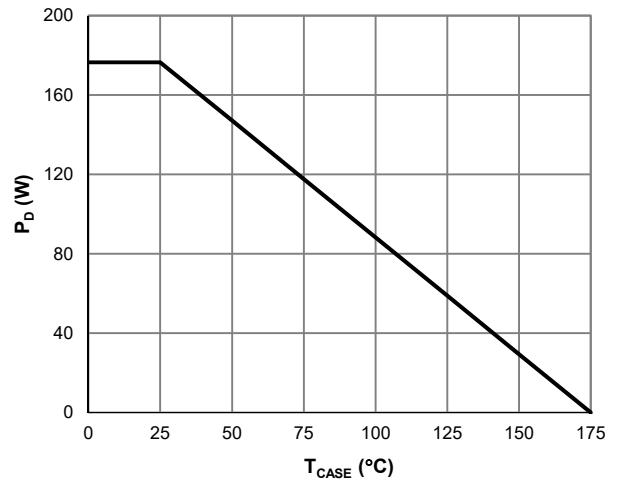
**Figure 7: Body-Diode Characteristics**



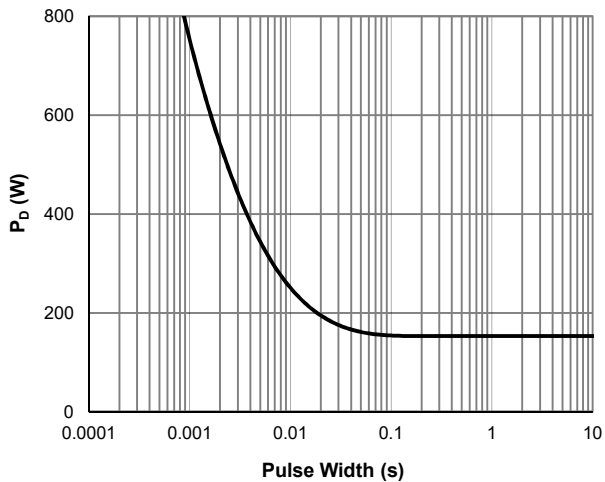
**Figure 8: Capacitance Characteristics**



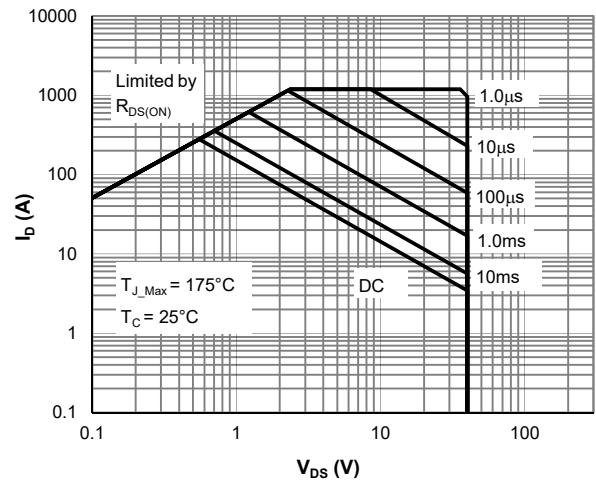
**Figure 9: Current De-rating**



**Figure 10: Power De-rating**

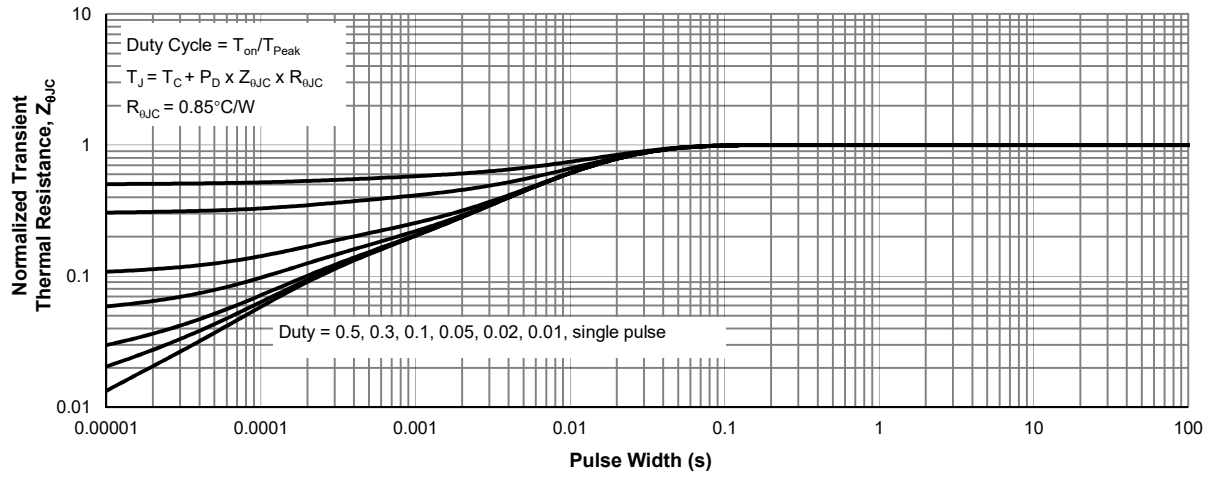


**Figure 11: Single Pulse Power Rating, Junction-to-Case**

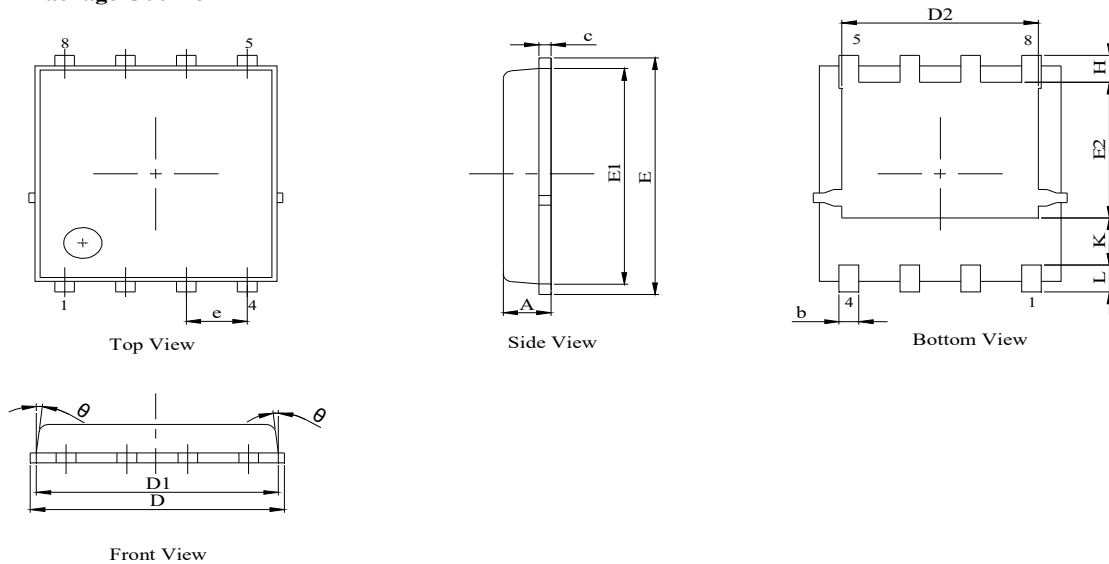


**Figure 12: Maximum Safe Operating Area**

### Typical Electrical & Thermal Characteristics



**Figure 13: Normalized Maximum Transient Thermal Impedance**

**PDFN5x6-8L Package Information**
**Package Outline**

**NOTES:**

1. Dimension and tolerance per ASME Y14.5M, 1994.
2. All dimensions in millimeter (angle in degree).
3. Dimensions D1 and E1 do not include mold flash protrusions or gate burrs.

| DIM.     | MILLIMETER |      |      |
|----------|------------|------|------|
|          | MIN.       | NOM. | MAX. |
| A        | 0.90       | 1.00 | 1.10 |
| b        | 0.31       | 0.41 | 0.51 |
| c        | 0.20       | 0.25 | 0.30 |
| D        | 5.00       | 5.20 | 5.40 |
| D1       | 4.95       | 5.05 | 5.15 |
| D2       | 4.00       | 4.10 | 4.20 |
| E        | 6.05       | 6.15 | 6.25 |
| E1       | 5.50       | 5.60 | 5.70 |
| E2       | 3.42       | 3.53 | 3.63 |
| e        | 1.27BSC    |      |      |
| H        | 0.60       | 0.70 | 0.80 |
| L        | 0.50       | 0.70 | 0.80 |
| $\theta$ | -          | -    | 10°  |

**Recommended Soldering Footprint**
