



- ★ Super Low Gate Charge
- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology

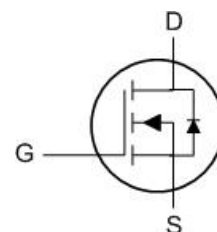
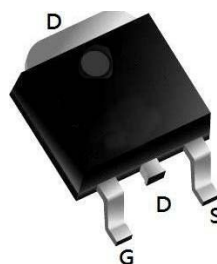
### Product Summary

| BVDSS | RDSON | ID  |
|-------|-------|-----|
| 30V   | 15mΩ  | 20A |

### Description

The XR20N03 is the high cell density trench N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications. The XR20N03 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

### TO252-3L Pin Configuration



### Absolute Maximum Ratings

| Symbol                      | Parameter                                  | Rating     |              | Units            |
|-----------------------------|--------------------------------------------|------------|--------------|------------------|
|                             |                                            | 10s        | Steady State |                  |
| $V_{DS}$                    | Drain-Source Voltage                       | 30         |              | V                |
| $V_{GS}$                    | Gate-Source Voltage                        | $\pm 20$   |              | V                |
| $I_D@T_C=25^\circ\text{C}$  | Continuous Drain Current, $V_{GS} @ 10V^1$ | 20         |              | A                |
| $I_D@T_C=100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 8          |              | A                |
| $I_{DM}$                    | Pulsed Drain Current <sup>2</sup>          | 38         |              | A                |
| EAS                         | Single Pulse Avalanche Energy <sup>3</sup> | 28         |              | mJ               |
| $I_{AS}$                    | Avalanche Current                          | 13.8       |              | A                |
| $P_D@T_C=25^\circ\text{C}$  | Total Power Dissipation <sup>4</sup>       | 5.5        |              | W                |
| $T_{STG}$                   | Storage Temperature Range                  | -55 to 175 |              | $^\circ\text{C}$ |
| $T_J$                       | Operating Junction Temperature Range       | -55 to 175 |              | $^\circ\text{C}$ |

### Thermal Data

| Symbol          | Parameter                                     | Typ. | Max. | Unit               |
|-----------------|-----------------------------------------------|------|------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup> | ---  | 36   | $^\circ\text{C/W}$ |

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

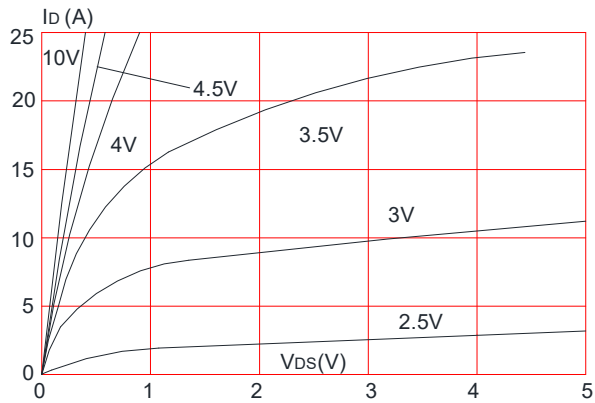
| Symbol                                                 | Parameter                                                | Test Condition                                                                          | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                          |                                                                                         |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                           | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                              | 30   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                          | V <sub>DS</sub> =30V, V <sub>GS</sub> = 0V,                                             | -    | -    | 1.0  | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                             | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V                                             | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                          |                                                                                         |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                   | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                | 1.0  | 1.5  | 2.5  | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br>note3               | V <sub>GS</sub> =10V, I <sub>D</sub> =5A                                                | -    | 15   | 20   | mΩ    |
|                                                        |                                                          | V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A                                               | -    | 21   | 29   |       |
| Dynamic Characteristics                                |                                                          |                                                                                         |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                        | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                  | -    | 490  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                       |                                                                                         | -    | 79   | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                             |                                                                                         | -    | 61   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                        | V <sub>DS</sub> =15V, I <sub>D</sub> =5.8A,<br>V <sub>GS</sub> =10V                     | -    | 10   | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                       |                                                                                         | -    | 1.7  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                              |                                                                                         | -    | 2.5  | -    | nC    |
| Switching Characteristics                              |                                                          |                                                                                         |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                       | V <sub>DS</sub> =15V, I <sub>D</sub> =3A,<br>V <sub>GS</sub> =10V, R <sub>REN</sub> =3Ω | -    | 6    | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                        |                                                                                         | -    | 15   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                      |                                                                                         | -    | 17   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                       |                                                                                         | -    | 17   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                          |                                                                                         |      |      |      |       |
| I <sub>s</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current |                                                                                         | -    | -    | 9    | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                         | -    | -    | 36   | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> =0V, I <sub>s</sub> =9A                                                 | -    | -    | 1.2  | V     |
| t <sub>rr</sub>                                        | Body Diode Reverse Recovery Time                         | I <sub>F</sub> =5A, dI/dt=100A/μs                                                       | -    | 7    | -    | ns    |
| Q <sub>rr</sub>                                        | Body Diode Reverse Recovery Charge                       |                                                                                         | -    | 2    | -    | nC    |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

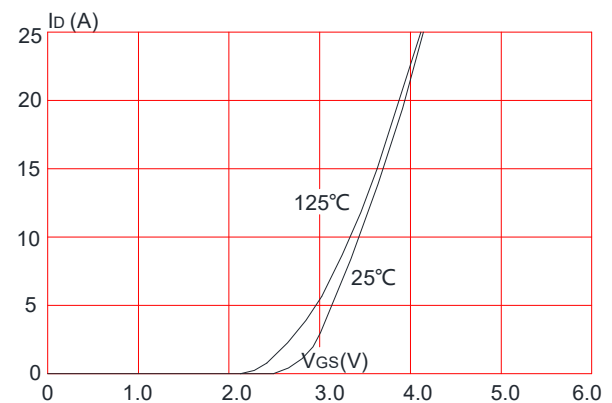
2. EAS condition :  $T_J=25^\circ\text{C}, V_{DD}=15V, V_G=10V, L=0.5mH, R_g=25\Omega, I_{AS}=6A$ 3. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

### Typical Performance Characteristics

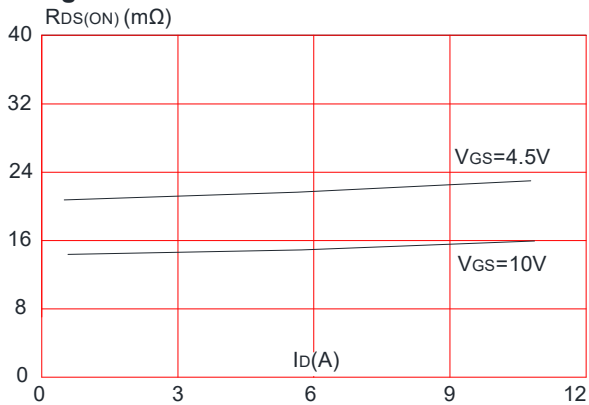
**Figure1: Output Characteristics**



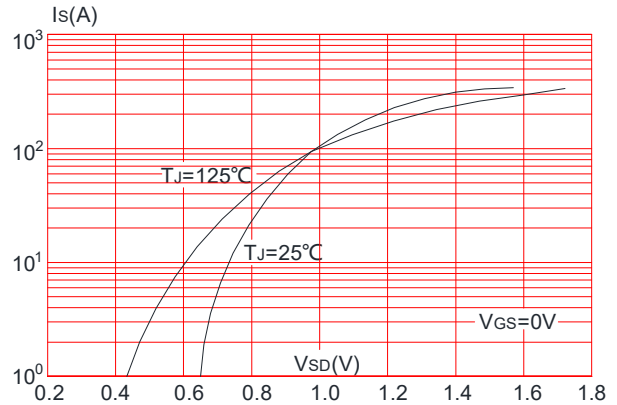
**Figure 2: Typical Transfer Characteristics**



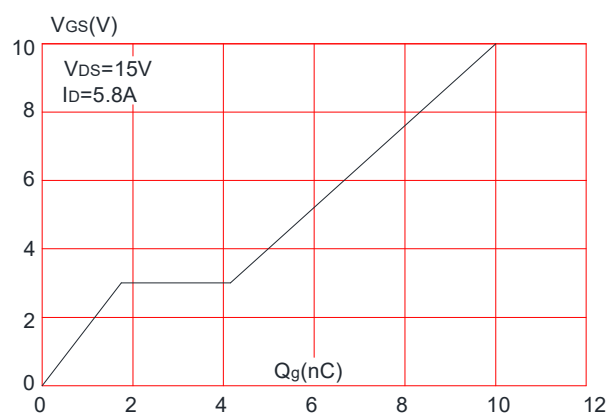
**Figure 3: On-resistance vs. Drain Current**



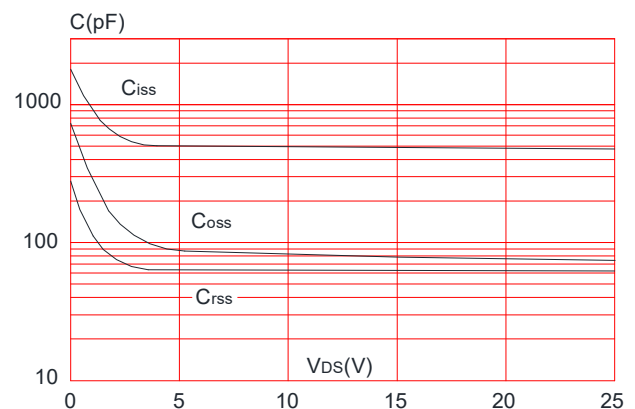
**Figure 4: Body Diode Characteristics**



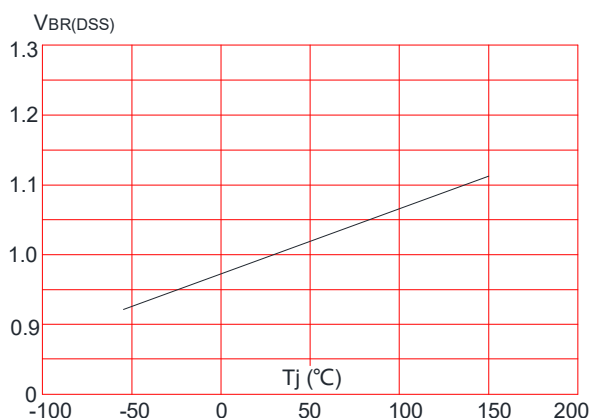
**Figure 5: Gate Charge Characteristics**



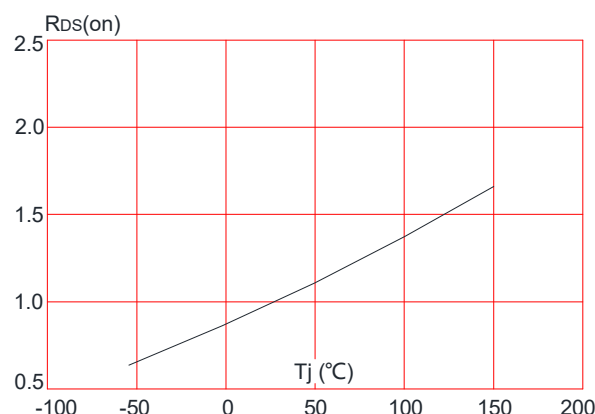
**Figure 6: Capacitance Characteristics**



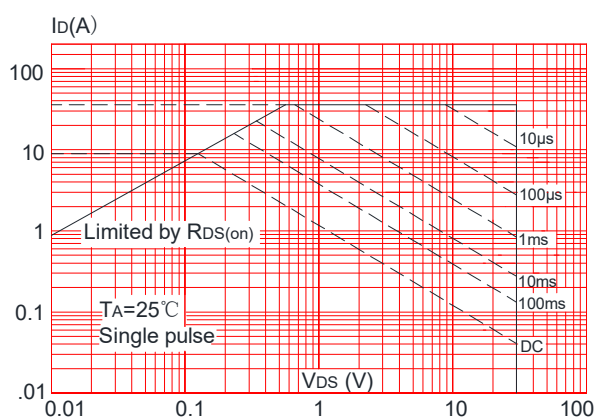
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



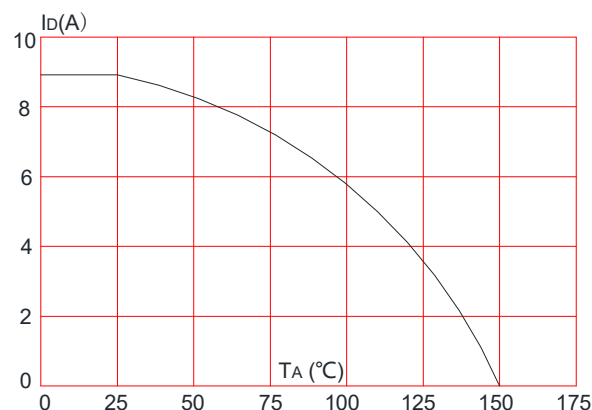
**Figure 8:** Normalized on Resistance vs. Junction Temperature



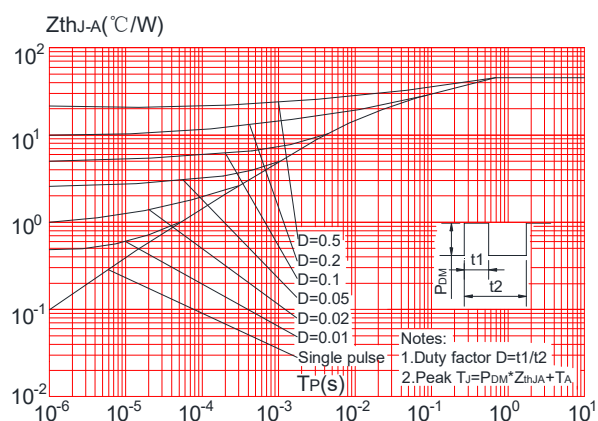
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



**Figure 11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



### Test Circuit

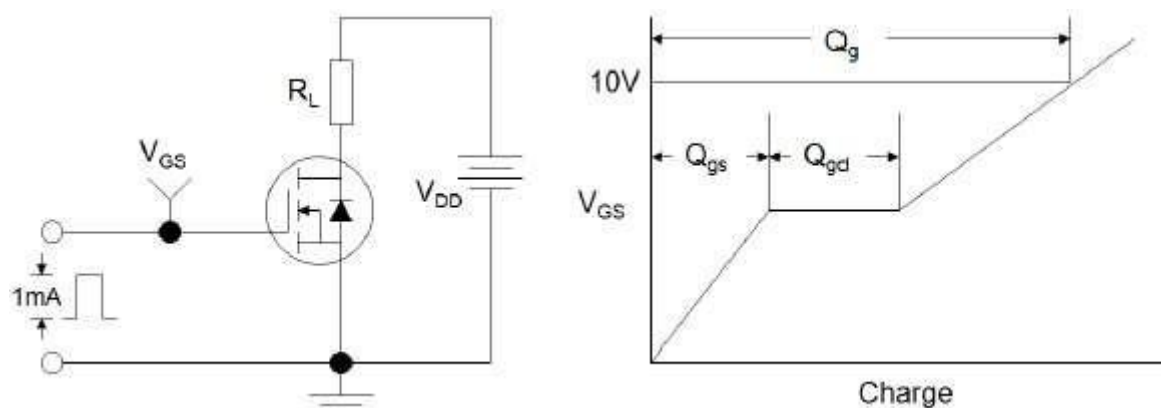


Figure1:Gate Charge Test Circuit & Waveform

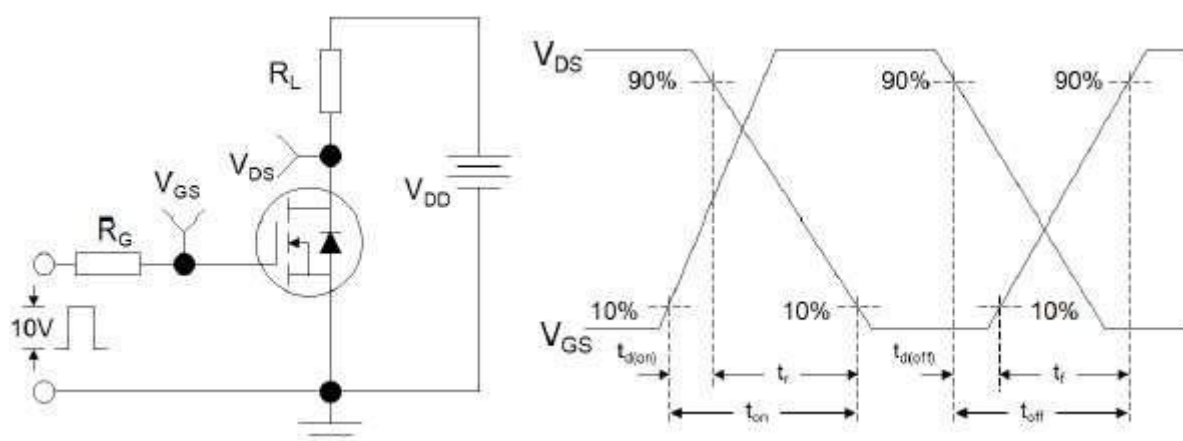


Figure 2: Resistive Switching Test Circuit & Waveforms

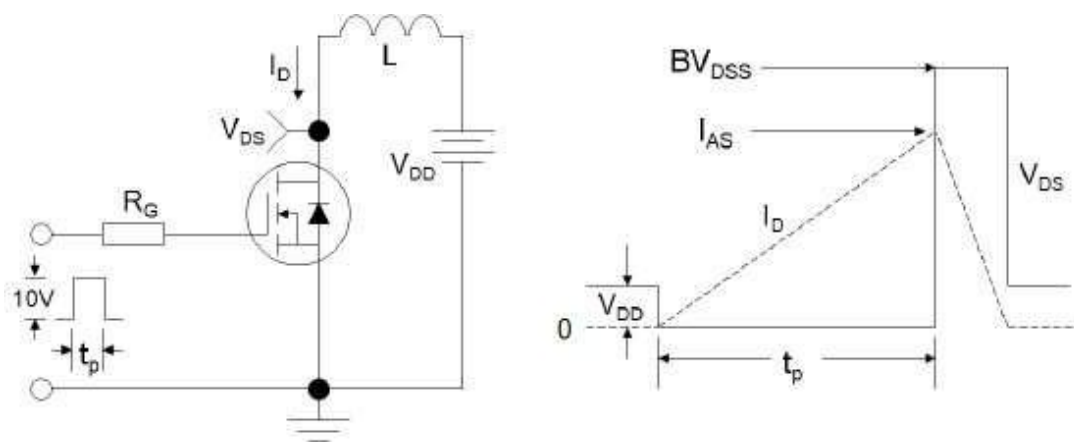
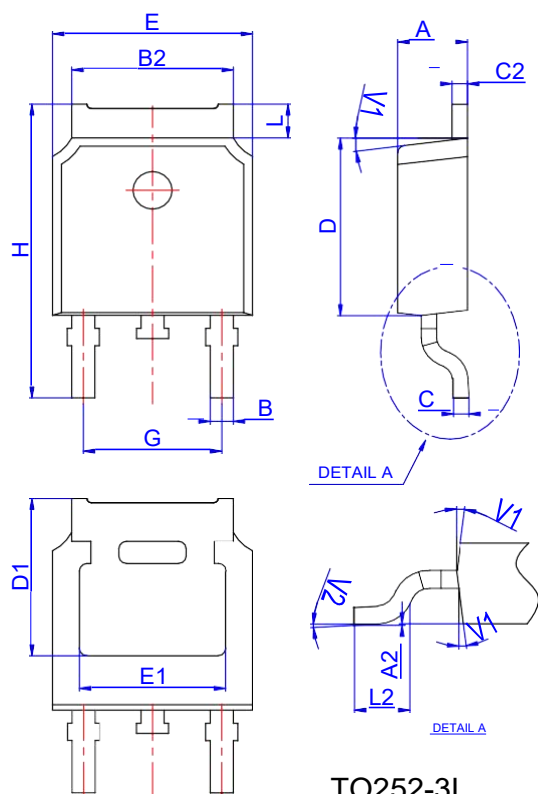


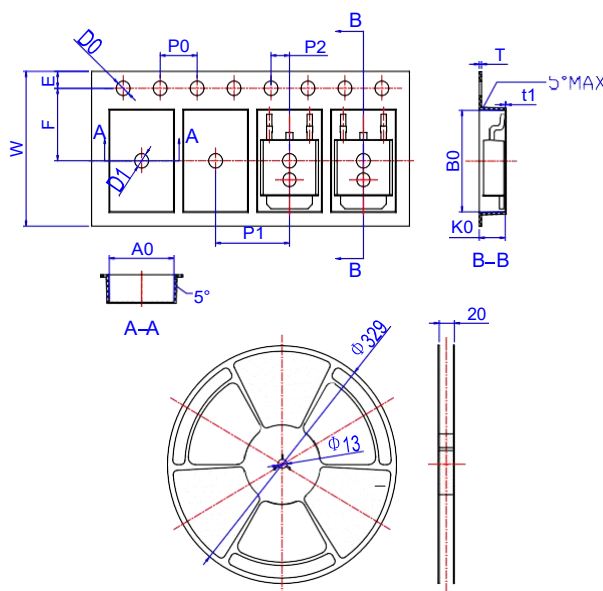
Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms

### Package Mechanical Data TO252-3L



| Ref. | Dimensions  |      |       |          |      |       |
|------|-------------|------|-------|----------|------|-------|
|      | Millimeters |      |       | Inches   |      |       |
|      | Min.        | Typ. | Max.  | Min.     | Typ. | Max.  |
| A    | 2.10        |      | 2.50  | 0.083    |      | 0.098 |
| A2   | 0           |      | 0.10  | 0        |      | 0.004 |
| B    | 0.66        |      | 0.86  | 0.026    |      | 0.034 |
| B2   | 5.18        |      | 5.48  | 0.202    |      | 0.216 |
| C    | 0.40        |      | 0.60  | 0.016    |      | 0.024 |
| C2   | 0.44        |      | 0.58  | 0.017    |      | 0.023 |
| D    | 5.90        |      | 6.30  | 0.232    |      | 0.248 |
| D1   | 5.30REF     |      |       | 0.209REF |      |       |
| E    | 6.40        |      | 6.80  | 0.252    |      | 0.268 |
| E1   | 4.63        |      |       | 0.182    |      |       |
| G    | 4.47        |      | 4.67  | 0.176    |      | 0.184 |
| H    | 9.50        |      | 10.70 | 0.374    |      | 0.421 |
| L    | 1.09        |      | 1.21  | 0.043    |      | 0.048 |
| L2   | 1.35        |      | 1.65  | 0.053    |      | 0.065 |
| V1   |             | 7°   |       |          | 7°   |       |
| V2   | 0°          |      | 6°    | 0°       |      | 6°    |

### Reel Specification-TO252-3L



| Ref. | Dimensions  |       |       |        |       |       |
|------|-------------|-------|-------|--------|-------|-------|
|      | Millimeters |       |       | Inches |       |       |
|      | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| W    | 15.90       | 16.00 | 16.10 | 0.626  | 0.630 | 0.634 |
| E    | 1.65        | 1.75  | 1.85  | 0.065  | 0.069 | 0.073 |
| F    | 7.40        | 7.50  | 7.60  | 0.291  | 0.295 | 0.299 |
| D0   | 1.40        | 1.50  | 1.60  | 0.055  | 0.059 | 0.063 |
| D1   | 1.40        | 1.50  | 1.60  | 0.055  | 0.059 | 0.063 |
| P0   | 3.90        | 4.00  | 4.10  | 0.154  | 0.157 | 0.161 |
| P1   | 7.90        | 8.00  | 8.10  | 0.311  | 0.315 | 0.319 |
| P2   | 1.90        | 2.00  | 2.10  | 0.075  | 0.079 | 0.083 |
| A0   | 6.85        | 6.90  | 7.00  | 0.270  | 0.271 | 0.276 |
| B0   | 10.45       | 10.50 | 10.60 | 0.411  | 0.413 | 0.417 |
| K0   | 2.68        | 2.78  | 2.88  | 0.105  | 0.109 | 0.113 |
| T    | 0.24        |       | 0.27  | 0.009  |       | 0.011 |
| t1   | 0.10        |       |       | 0.004  |       |       |
| 10P0 | 39.80       | 40.00 | 40.20 | 1.567  | 1.575 | 1.583 |