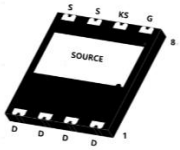
## Features

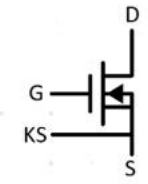
- Easy to use, compatible with standard gate drivers
- Excellent $Q_G$ x $R_{DS(on)}$ figure of merit (FOM)
- Low $Q_{RR}$, no free-wheeling diode required
- Low switching loss
- RoHS compliant and Halogen-free
- Qualified according to JEDEC criteria•

| Product Summary | | |
|---|---|---|
| $V_{DSS}$ | 700 | V |
| $R_{DS(on),typ}$ | 180 | mΩ |
| $Q_{G,typ}$ | 5.6 | nC |
| $Q_{RR,typ}$ | 26 | nC |

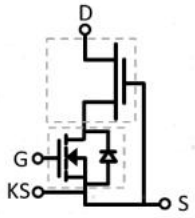
## Applications

- High efficiency power supplies
- High efficiency USB PD adapters
- Other consumer electronics



Schematic Symbol



Cascode
Device Structure

| Part Number | Marking | Package | Packaging | Base QTY |
|---|---|---|---|---|
| CRNLE180C70L | CRNLE180C70L | DFN 8 x 8 - 8 | Tape and Reel | 2500 |

### Packaging

### Maximum ratings, at $T_C$=25 °C, unless otherwise specified

| Symbol | Parameter | | Limit Value | Unit |
|---|---|---|---|---|
| $I_D$ | Continuous drain current @$T_C$=25° C | | 12.5 | A |
| | Continuous drain current @$T_C$=100° C | | 7.9 | A |
| $I_{DM}$ | Pulsed drain current @$T_C$=25° C (pulse width: 100us) | | 29 | A |
| | Pulsed drain current @$T_C$=150° C (pulse width: 100us) | | 21 | A |
| $V_{DSS}$ | Drain to source voltage ($T_J$ = -55° C to 150° C) | | 700 | V |
| $V_{TDSS}$ | Transient drain to source voltage [a] | | 800 | V |
| $V_{GSS}$ | Gate to source voltage | | ±20 | V |
| $P_D$ | Maximum power dissipation @$T_C$=25° C | | 60 | W |
| $T_C$ | Operating temperature | Case | -55 to 150 | ° C |
| $T_J$ | | Junction | -55 to 150 | ° C |
| $T_S$ | Storage temperature | | -55 to 150 | ° C |
| $T_{CSOLD}$ | Soldering peak temperature | | 260 | ° C |

## Thermal Resistance

| Symbol | Parameter | Typical | Unit |
|---|---|---|---|
| $R_{\Theta JC}$ | Junction-to-case | 2.1 | °C/W |
| $R_{\Theta JA}$ | Junction-to-ambient [b] | 50 | °C/W |

Notes:
a. Off-state spike duty cycle < 0.01, spike duration < 2us
b. Device on one layer epoxy PCB for drain connection (vertical and without air stream cooling, with 6cm$^2$copper area and 70μm thickness)

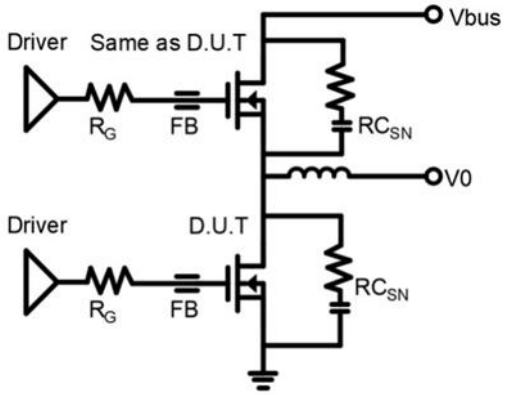
## Electrical Parameters, at $T_J$=25°C, unless otherwise specified

| Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|
| **Forward Characteristics** | | | | | |
| $V_{DSS-MAX}$ | 700 | - | - | V | $V_{GS}$=0V |
| $BV_{DSS}$ | - | 1000 | - | V | $V_{GS}$=0V, $I_{DSS}$=250μA |
| $V_{GS(th)}$ | 1.4 | 2.1 | 2.8 | V | $V_{DS}$=$V_{GS}$, $I_D$=500μA |
| $R_{DS(on)}$ [c] | - | 180 | 225 | mΩ | $V_{GS}$=12V, $I_D$=4A, $T_J$=25°C |
| | - | 360 | - | | $V_{GS}$=12V, $I_D$=4A, $T_J$=150°C |
| $I_{DSS}$ | - | 5 | 20 | μA | $V_{DS}$=700V, $V_{GS}$=0V, $T_J$=25°C |
| | - | 50 | - | μA | $V_{DS}$=700V, $V_{GS}$=0V, $T_J$=150°C |
| $I_{GSS}$ | - | - | 150 | nA | $V_{GS}$=20V |
| | - | - | -150 | nA | $V_{GS}$=-20V |
| $C_{ISS}$ | - | 316 | - | pF | $V_{GS}$=0V, $V_{DS}$=400V, f=1MHz |
| $C_{OSS}$ | - | 21 | - | pF | |
| $C_{RSS}$ | - | 1.3 | - | pF | |
| $C_{O(er)}$ | - | 30 | - | pF | $V_{GS}$=0V, $V_{DS}$=0 - 400V |
| $C_{O(tr)}$ | - | 60 | - | pF | |
| $Q_{oss}$ | - | 24 | - | nC | |
| $Q_G$ | - | 5.6 | - | nC | $V_{DS}$=400V, $V_{GS}$=0 - 12V, $I_D$=6A |
| $Q_{GS}$ | - | 1.5 | - | | |
| $Q_{GD}$ | - | 2 | - | | |
| $t_{D(on)}$ | - | 12 | - | ns | $V_{DS}$=400V, $V_{GS}$=0 - 12V, $I_D$=6A, $R_G$=47Ω |
| $t_R$ | - | 11 | - | | |
| $t_{D(off)}$ | - | 54 | - | | |
| $t_F$ | - | 6 | - | | |
| **Reverse Characteristics** | | | | | |
| $V_{SD}$ | - | 1.4 | - | V | $V_{GS}$=0V, $I_S$=3A, $T_J$=25°C |
| | - | 2.1 | - | | $V_{GS}$=0V, $I_S$=6A, $T_J$=25°C |
| | - | 3.2 | - | | $V_{GS}$=0V, $I_S$=6A, $T_J$=150°C |
| $t_{RR}$ | - | 18 | - | ns | $I_S$=6A, $V_{GS}$=0V, $d_i/d_t$=1000A/us, $V_{DD}$=400V |
| $Q_{RR}$ | - | 26 | - | nC | |

Notes:
c. Dynamic on-resistance; see Figure 19 and 20 for test circuit and configurations

## Circuit Implementation

(1) Mostly used in half bridge and full bridge topology



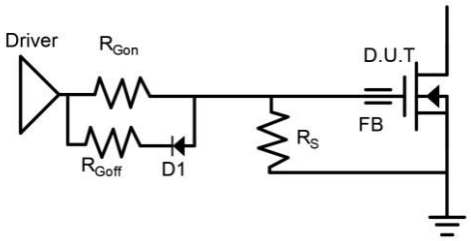

**Recommended Half-bridge Circuit**

Recommended gate drive: (0 V, 8 V) with $R_{G(tot)}$ = 40 Ω, where $R_{G(tot)} = R_G + R_{driver}$

| Gate Ferrite Bead (FB) | Gate Resistance ($R_G$) | RC Snubber ($RC_{SN}$) |
|---|---|---|
| MPZ1608S471ATA00 | 33 Ω | 69 pF + 15 Ω |

Notes:
d. $RC_{SN}$ should be placed as close as possible to the drain pin
e. The layout and wiring of the drive circuit should be as short as possible

(2) Mostly used in flyback, forward and push-pull converters



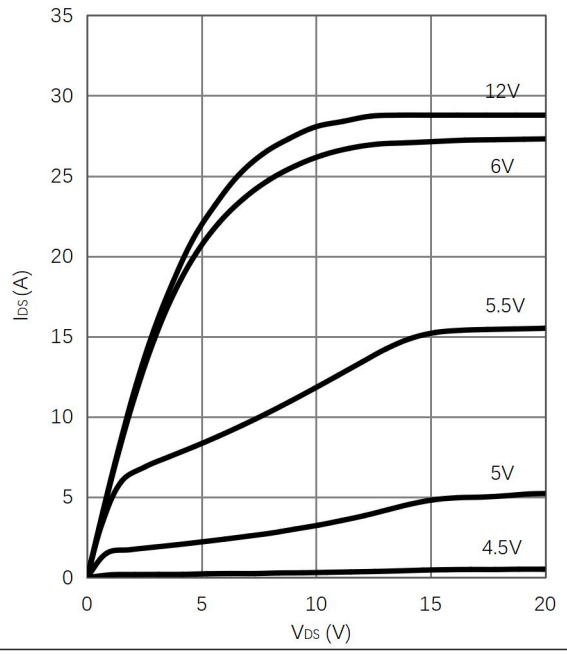

**Recommended Single Ended Drive Circuit**

Recommended gate drive: (0 V, 12 V) with $R_{Gon}$ = 300 - 500 Ω, $R_{Goff}$ =10 Ω

| Gate Ferrite Bead(FB) | Gate Source Resistance($R_S$) | Gate Diode (D1) |
|---|---|---|
| 300 - 600 Ω@100MHz | 10 kΩ | 1N4148 |

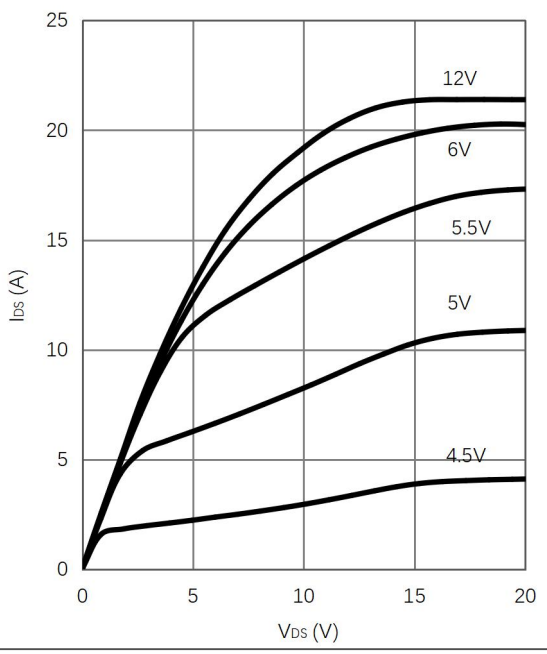
## Typical Characteristics, at $T_C$=25 ° C, unless otherwise specified

**Figure 1. Typical Output Characteristics $T_J$=25° C**



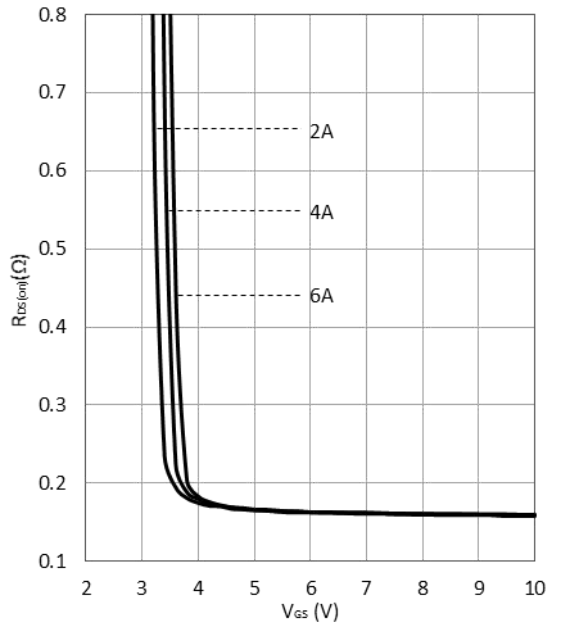

Parameter: $V_{GS}$

**Figure 2. Typical Output Characteristics $T_J$=150° C**



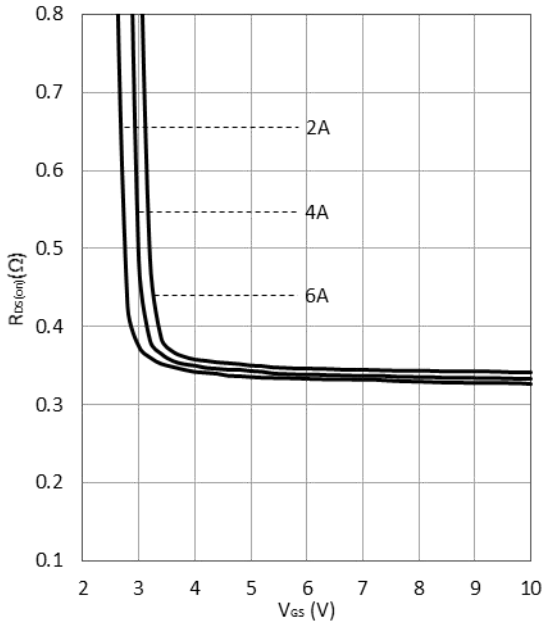

Parameter: $V_{GS}$

**Figure 3.Typical Drain to Source On-resistance $T_J$= 25° C**



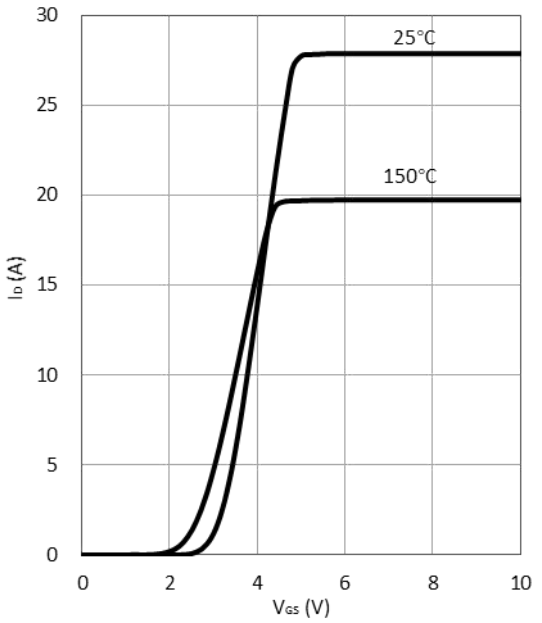

Parameter: $I_D$

**Figure 4. Typical Drain to Source On-resistance $T_J$= 150° C**



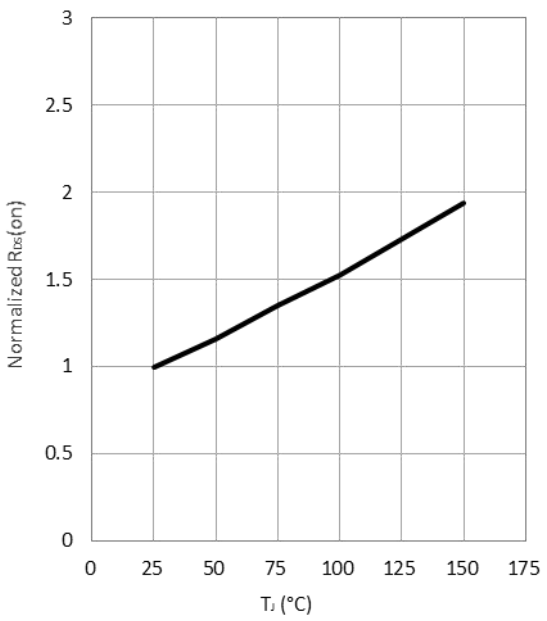

Parameter: $I_D$

**Figure 5. Typical Transfer Characteristics**



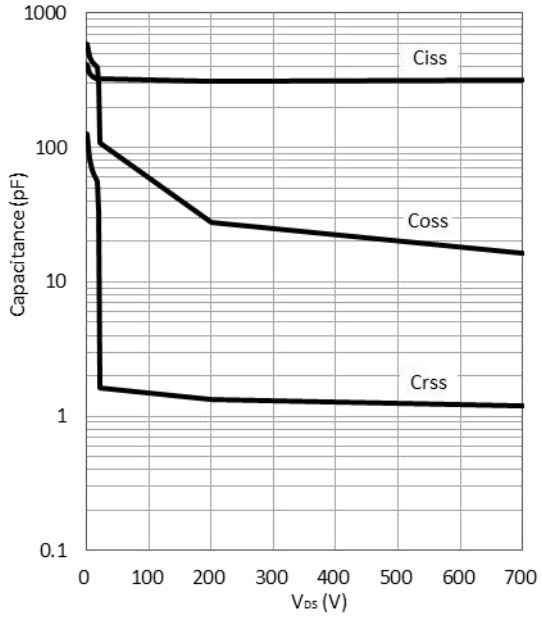

$V_{DS}$=10V, Parameter: $T_J$

**Figure 6. Normalized On-resistance**



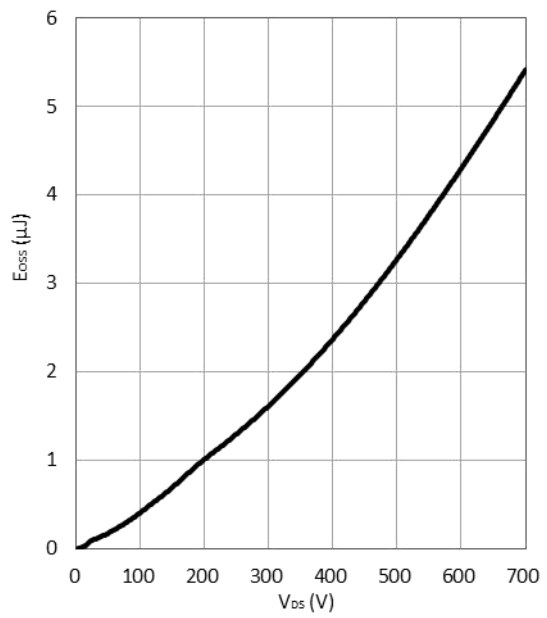

$I_D$=4A, $V_{GS}$=12V

**Figure 7. Typical Capacitance**



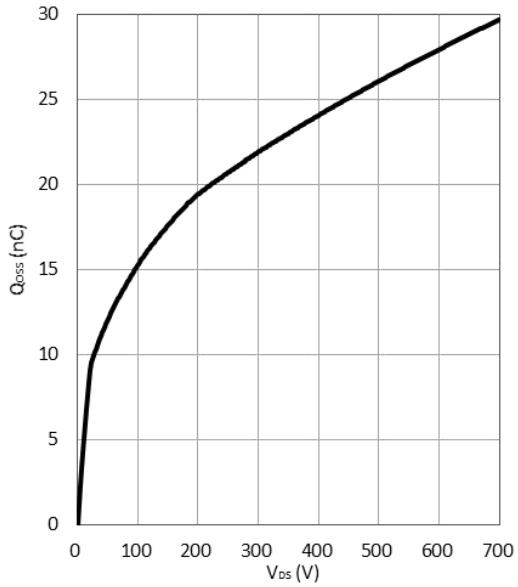

$V_{GS}$=0V, f=1MHz

**Figure 8. Typical Coss Stored Energy**



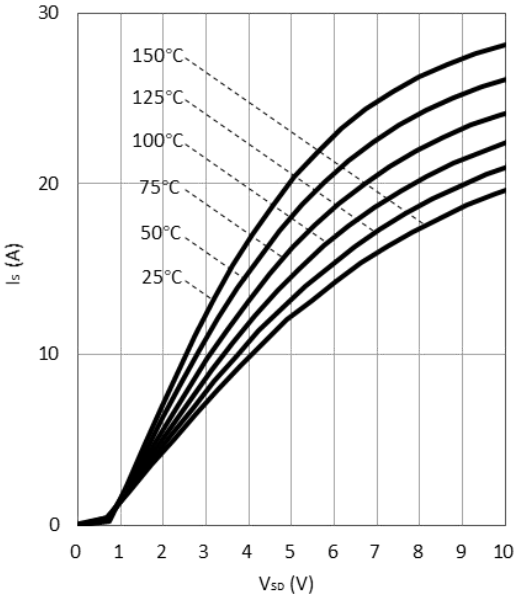

$V_{GS}$=0V, f=1MHz

**Figure 9. Typical Qoss**



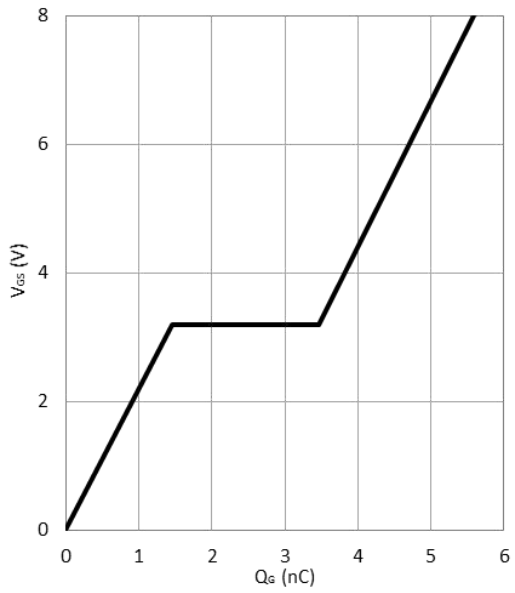

$V_{GS}$=0V, f=1MHz

**Figure 10. Forward Characteristic of Rev. Diode**




Is=f($V_{SD}$), Parameter $T_J$

**Figure 11. Typical Gate Charge**




$I_{DS}$=6A, $V_{DS}$=400V

**Figure 12. Power Dissipation**

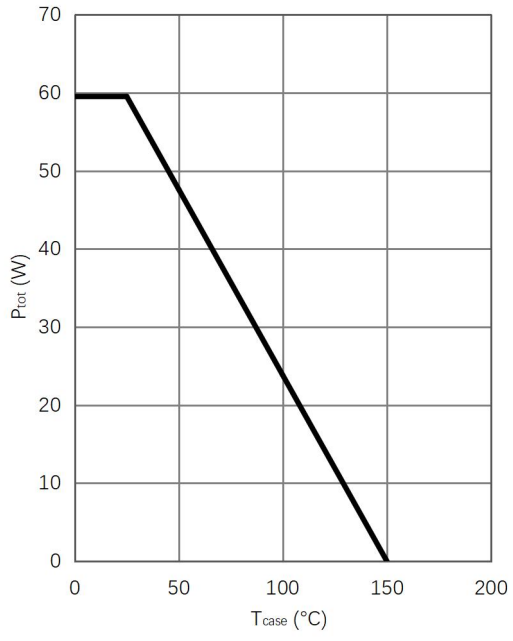


**Figure 13. Current Derating**

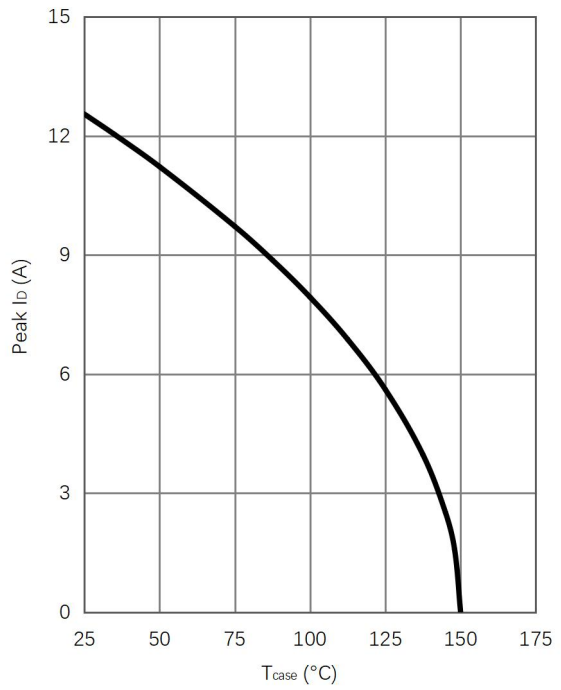



**Figure 14. Transient Thermal Resistance**

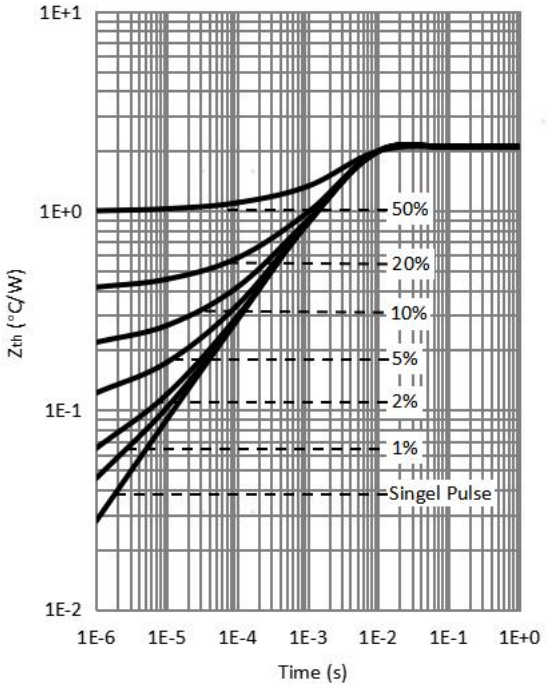
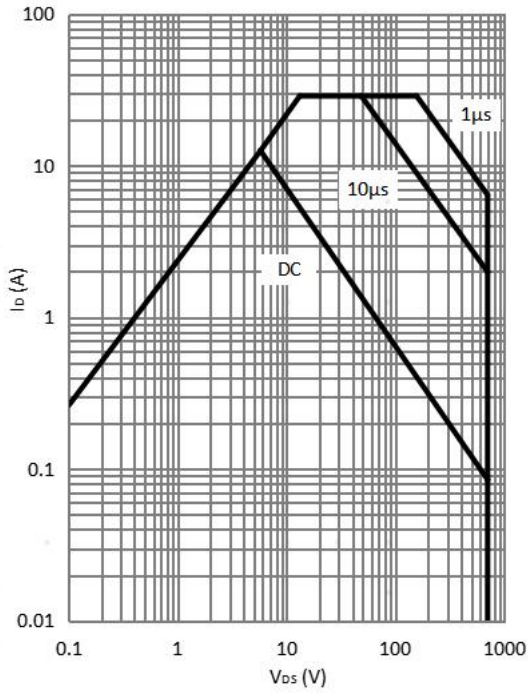
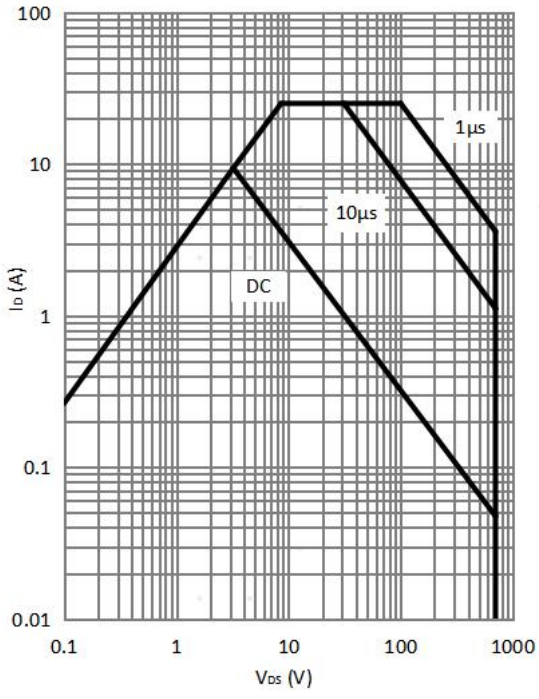



**Figure 15. Safe Operating Area $T_C$=25° C**



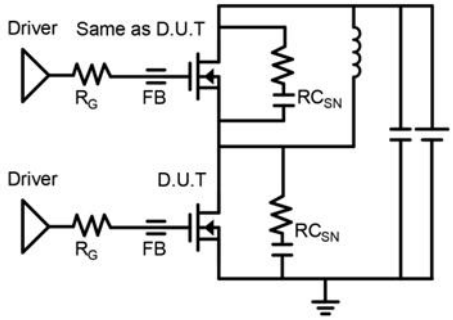
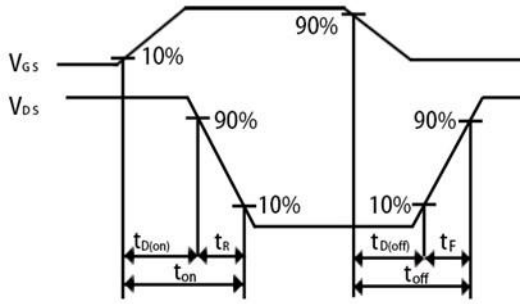

calculated based on thermal limit

**Figure 16. Safe Operating Area $T_C$=80° C**



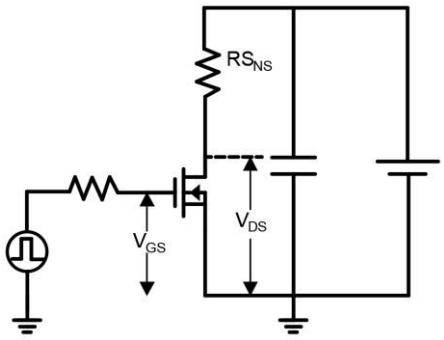
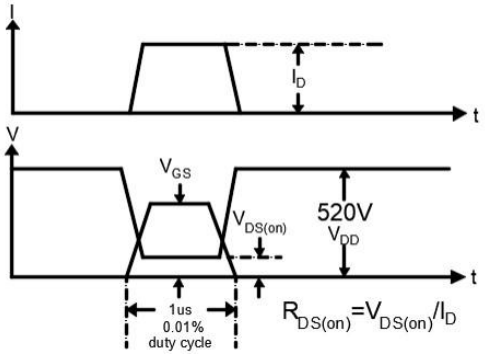

calculated based on thermal limit

## Test Circuits and Waveforms

| Figure 17. Switching Time Test Circuit | Figure 18. Switching Time Waveform |
|---|---|
|  |  |

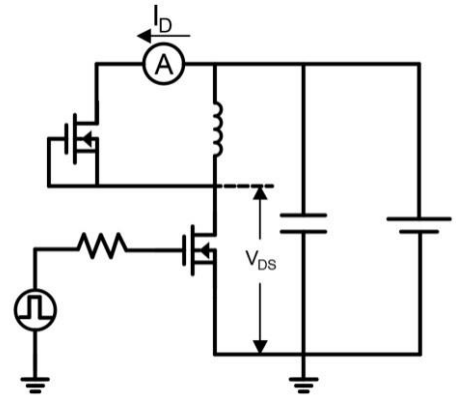
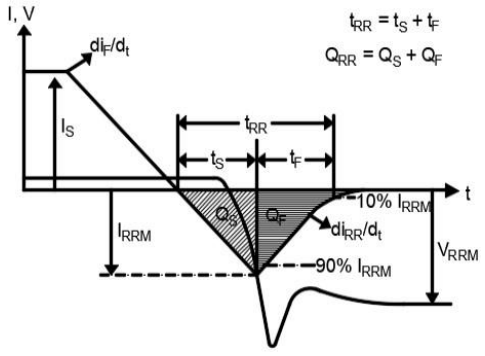




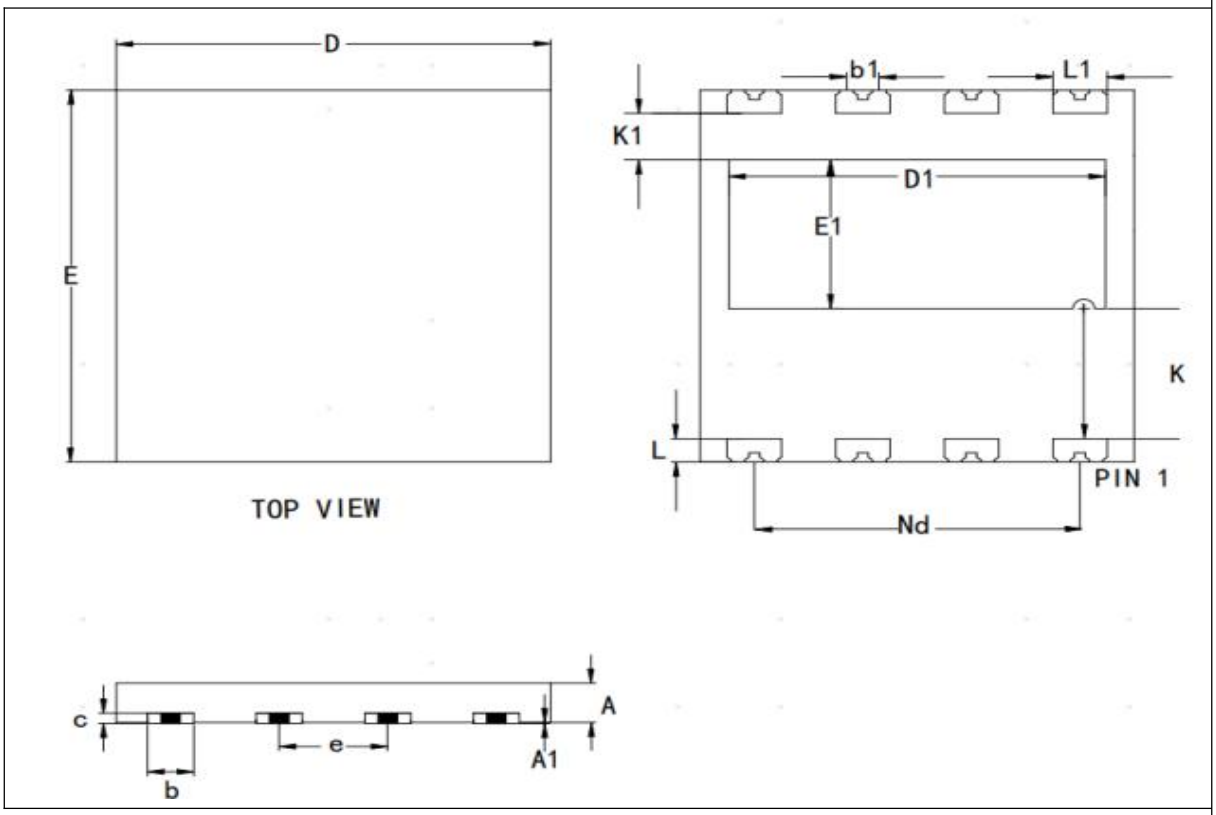
| Figure 19. Dynamic $R_{DS(on)}$ Test Circuit | Figure 20. Dynamic $R_{DS(on)}$ Waveform |
|---|---|
|  |  |





| Figure 21. Diode Characteristic Test Circuits | Figure 22. Diode Recovery Waveform |
|---|---|
|  |  |

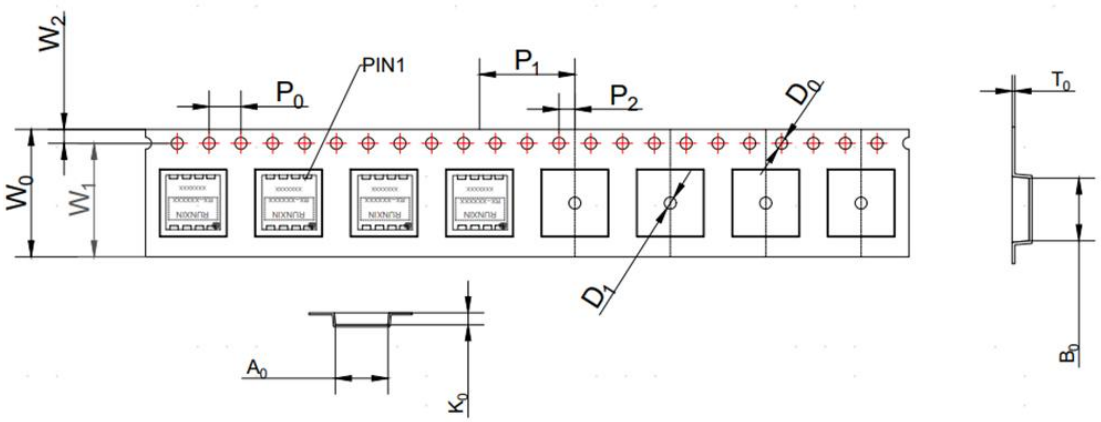
## Package Outline

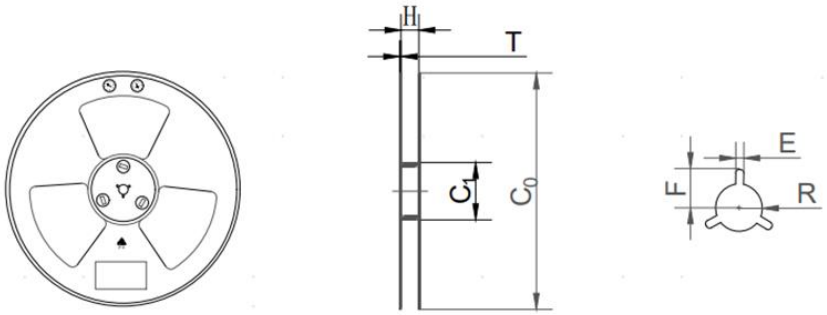



| SYMBOL | Millimeter | | |
|---|---|---|---|
| | Min | Nom | Max |
| A | 0.8 | 0.9 | 1.15 |
| A1 | 0 | 0.02 | 0.05 |
| c | — | 0.2 | — |
| b | 0.9 | 1 | 1.1 |
| b1 | 0.5 | 0.6 | 0.7 |
| D | 7.9 | 8 | 8.1 |
| D1 | 6.85 | 6.95 | 7.05 |
| E | 7.9 | 8 | 8.1 |
| E1 | 3.1 | 3.2 | 3.3 |
| e | 2.00BSC | | |
| Nd | 6.00BSC | | |
| K | 2.7 | 2.8 | 2.9 |
| K1 | 0.9 | 1 | 1.1 |
| L | 0.4 | 0.5 | 0.6 |
| L1 | 0.9 | 1 | 1.1 |

## Tape and Reel Information

**Dimensions are shown in millimeters**




| Tape Dimension(mm) | | | | | |
|---|---|---|---|---|---|
| $W_0$ | 16+0.3-0.2 | $P_0$ | 4±0.1 | $A_0$ | 8.3±0.1 |
| $W_1$ | 14.25±0.1 | $P_1$ | 12±0.1 | $B_0$ | 8.3±0.1 |
| $W_2$ | 1.75±0.1 | $P_2$ | 2±0.1 | $D_1$ | 1.5±0.25 |
| $K_0$ | 1.3±0.1 | $D_0$ | 1.5±0.1 | $T_0$ | 0.3±0.05 |

| Reel Dimension(mm) | | | |
|---|---|---|---|
| H | 17±0.1 | F | 10.5±0.1 |
| T | 2±0.2 | E | 2.8±0.1 |
| $C_0$ | 330±3 | R | 6.5±0.1 |
| $C_1$ | 100±1 | | |

## Revision History

| Version | Date | Change(s) |
|---|---|---|
| 0.1 | 2025/12/01 | Release preliminary datasheet |

## Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qualified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.