华润微电子(重庆)有限公司

# CRSM054N04L2DQ

SkyMOS2 N-MOSFET 40V, 4.3mΩ, 50A

## Features

- Uses CRM(CQ) advanced SkyMOS2 technology
- Extremely low on-resistance $R_{DS(on)}$
- Excellent $Q_g$x$R_{DS(on)}$ product(FOM)
- AEC-Q101 Qualified
- MSL1 up to 260°C peak reflow

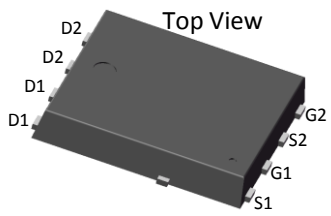
## Product Summary

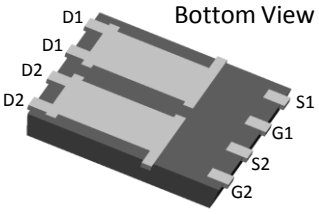
| | |
|---|---|
| $V_{DS}$ | 40V |
| $R_{DS(on).typ}$ | 4.3mΩ |
| $I_D$ | 50A |

## Applications

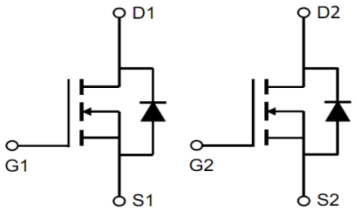
- Motor control and drive
- Battery management System

***100% DVDS Tested***
***100% Avalanche Tested***




CRSM054N04L2DQ




## Package Marking and Ordering Information

| Part # | Marking | Package | Packing | Reel Size | Tape Width | Qty |
|---|---|---|---|---|---|---|
| CRSM054N04L2DQ | 054N04L2DQ | DFN5*6 | Tape&reel | N/A | N/A | 4000pcs |

## Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | 40 | V |
| Continuous drain current<br>$T_C$ = 25°C (Silicon limit)<br>$T_C$ = 25°C (Package limit)<br>$T_C$ = 100°C (Silicon limit) | $I_D$ | <br>80<br>50<br>59 | A |
| Pulsed drain current ($T_C$ = 25°C, $t_p$ limited by $T_{jmax}$) | $I_{D\ pulse}$ | 200 | A |
| Avalanche energy, single pulse ($I_D$ = 36A, Rg=25Ω)[1] | $E_{AS}$ | 195 | mJ |
| Gate-Source voltage | $V_{GS}$ | ±20 | V |
| Power dissipation ($T_C$ = 25°C) | $P_{tot}$ | 45 | W |
| Operating junction and storage temperature | $T_j$ , $T_{stg}$ | -55...+175 | °C |
| Soldering temperature, wave soldering only allowed at leads (1.6mm from case for 10s) | Tsold | 260 | °C |

※. Notes:
1.EAS is tested at starting Tj = 25℃, L = 0.3mH, IAS =36A, Vds = 40V.


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## Thermal Resistance

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Thermal resistance, junction – case. | $R_{thJC}$ | 3.3 | °C/W |
| Thermal resistance, junction – ambient(min. footprint) | $R_{thJA}$ | 62 | |
| Thermal resistance, junction – plastic case | $R_{thj-pc}$ | 20 | |

## Electrical Characteristic (at Tj = 25 °C, unless otherwise specified)

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| **Static Characteristic** | | | | | | |
| Drain-source breakdown voltage | $BV_{DSS}$ | 40 | - | - | V | $V_{GS}$=0V, $I_D$=250uA |
| | | 40 | - | - | V | $V_{GS}$=0V, $I_D$=1mA |
| Gate threshold voltage | $V_{GS(th)}$ | 1.5 | - | 2.4 | V | $V_{DS}$=$V_{GS}$,$I_D$=250uA |
| Zero gate voltage drain current | $I_{DSS}$ | -<br>- | -<br>- | 1<br>100 | μA | $V_{DS}$=40V,$V_{GS}$=0V<br>$T_j$=25°C<br>$T_j$=125°C |
| Gate-source leakage current | $I_{GSS}$ | - | - | ±100 | nA | $V_{GS}$=±20V,$V_{DS}$=0V |
| Drain-source on-state resistance | $R_{DS(on)}$ | - | 4.3 | 5.4 | mΩ | VGS=10V, ID=40A |
| | | - | 6.2 | 8.0 | | VGS=4.5V, ID=32A |
| Transconductance | $g_{fs}$ | | 115 | 230 | S | $V_{DS}$=5V, $I_D$=40A |
| **Dynamic Characteristic** | | | | | | |
| Input Capacitance | $C_{iss}$ | 840 | 1680 | 3360 | pF | VGS=0V, VDS=20V, f=1MHz |
| Output Capacitance | $C_{oss}$ | 320 | 640 | 1280 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | - | 22 | 110 | | |
| Gate Total Charge | $Q_G$ | 14 | 28 | 56 | nC | VGS=10V, VDS=20V, ID=40A, f=1MHz |
| Gate-Source charge | $Q_{gs}$ | - | 9 | 18 | | |
| Gate-Drain charge | $Q_{gd}$ | - | 4.2 | 21 | | |
| Turn-on delay time | $t_{d(on)}$ | - | 8 | 16 | ns | Vds=20V Id=40A Rg=3Ω Vgs=10V |
| Rise time | $t_r$ | - | 23 | 46 | | |
| Turn-off delay time | $t_{d(off)}$ | - | 22 | 44 | | |
| Fall time | $t_f$ | - | 8 | 22.8 | | |
| Gate resistance | $R_G$ | - | 1.3 | 2.5 | Ω | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz |


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**Body Diode Characteristic**

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| Body Diode Forward Voltage | $V_{SD}$ | - | 0.9 | 1.4 | V | $V_{GS}$=0V, $I_{SD}$=40A |
| Body Diode Reverse Recovery Time | $t_{rr}$ | 15 | 30 | 60 | ns | $I_F$=40A,dI/dt=100A/μs |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | 10 | 19 | 38 | nC | |


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## Typical Performance Characteristics

Fig 1: Output Characteristics

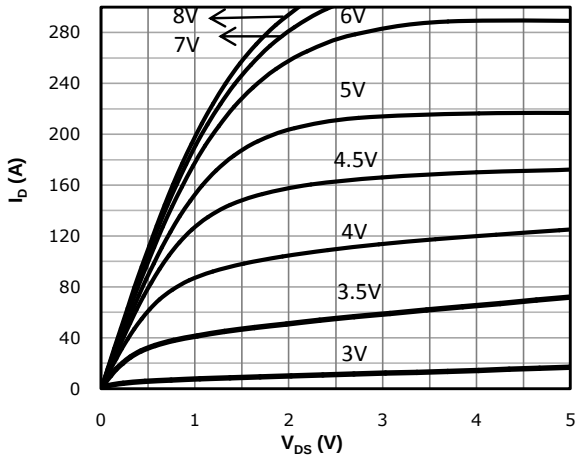



Fig 2: Transfer Characteristics

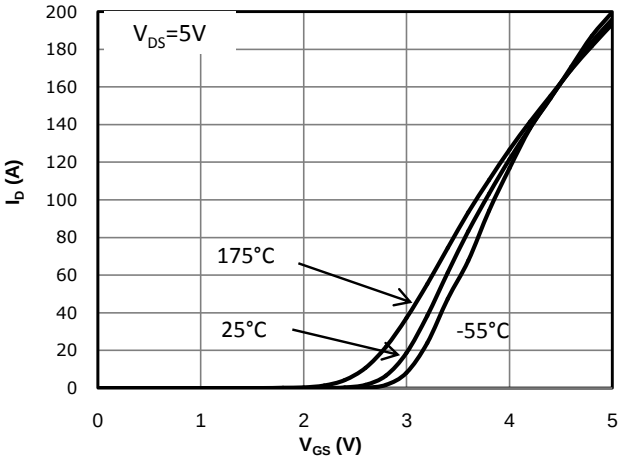



Fig 3: Rds(on) vs Drain Current and Gate Voltage

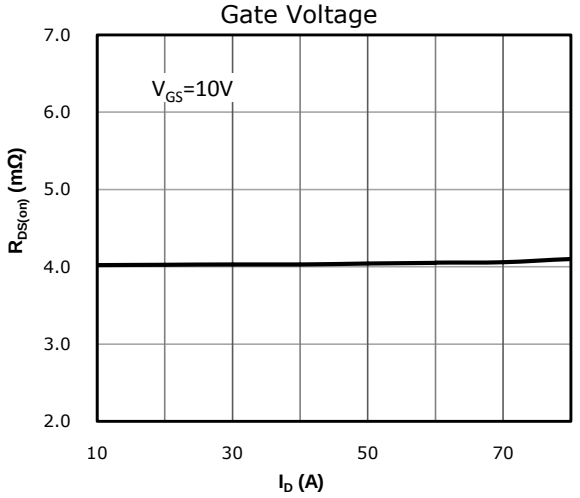



Fig 4: Rds(on) vs Gate Voltage

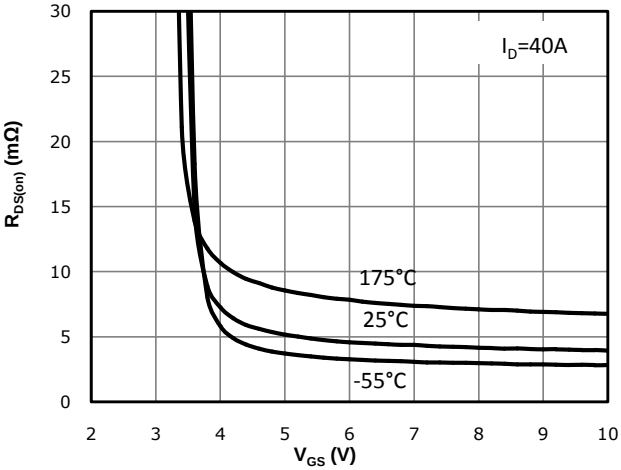



Fig 5: Rds(on) vs. Temperature

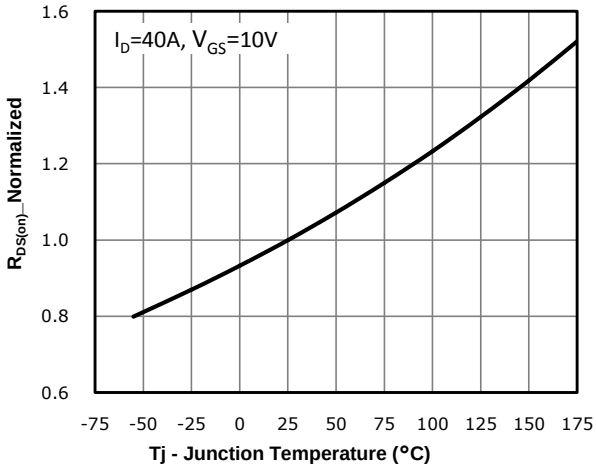
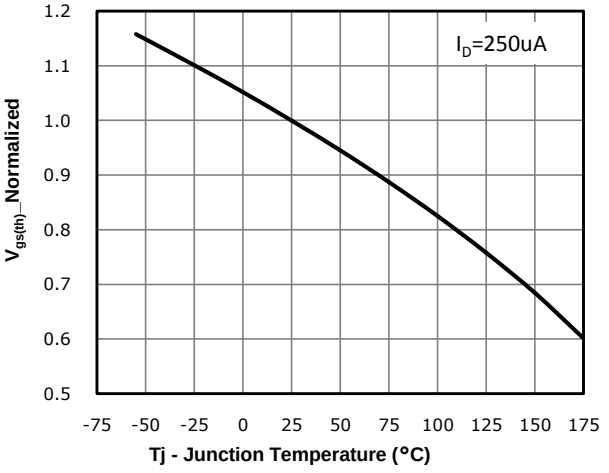



Fig 6: Vgs(th) vs. Temperature





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Fig 7: BVdss vs. Temperature

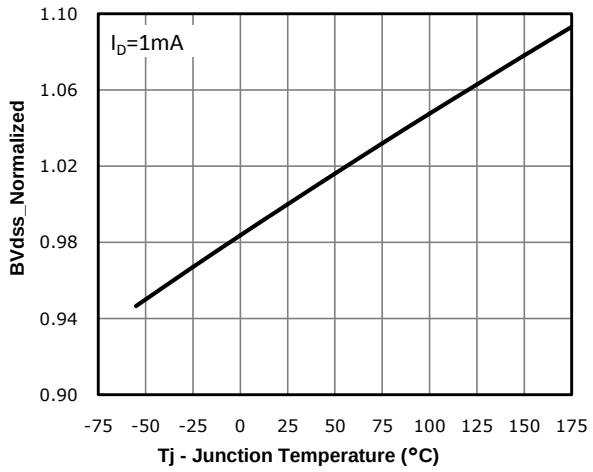



Fig 8: Capacitance Characteristics

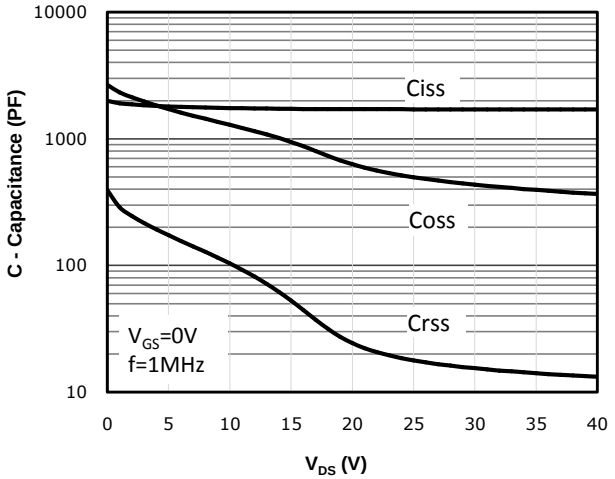



Fig 9: Gate Charge Characteristics

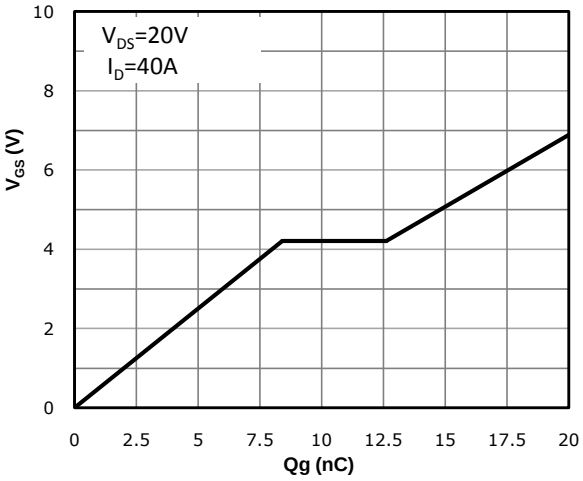



Fig 10: Body-diode Forward Characteristics

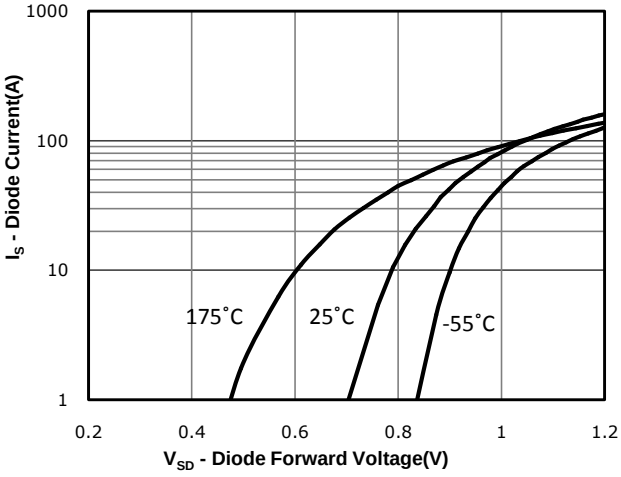



Fig 11: Power Dissipation

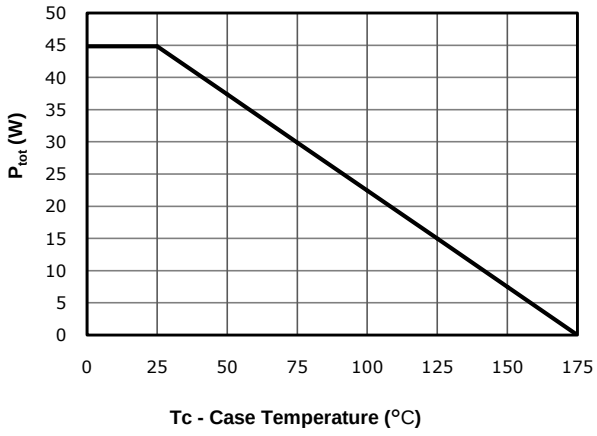
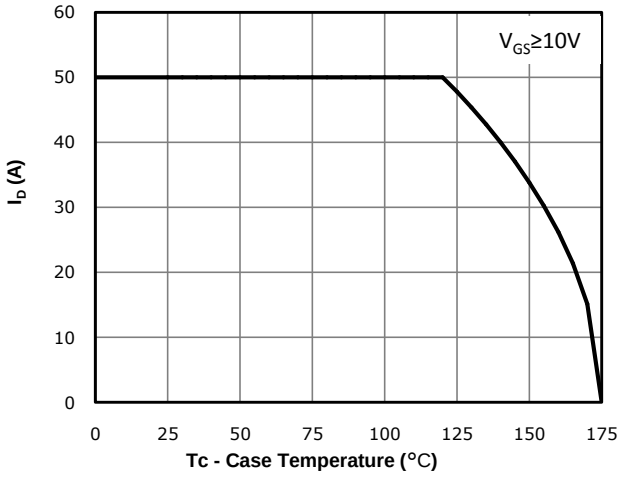



Fig 12: Drain Current Derating





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Fig 13: Safe Operating Area

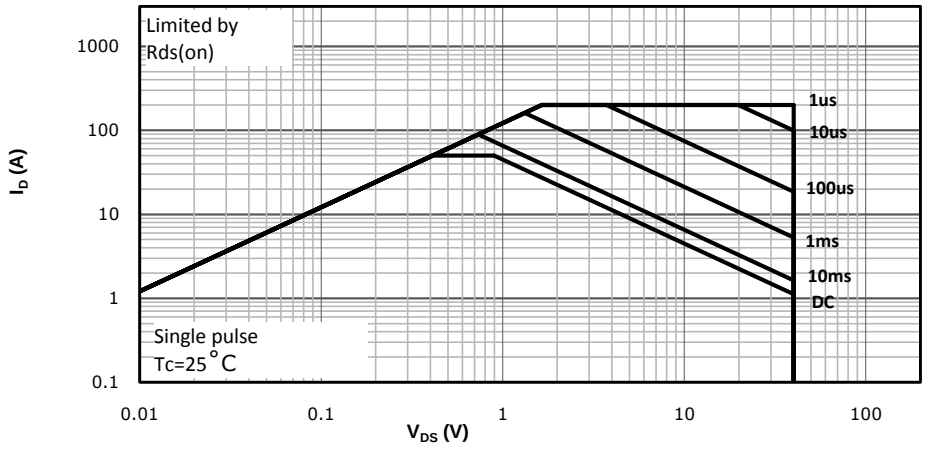
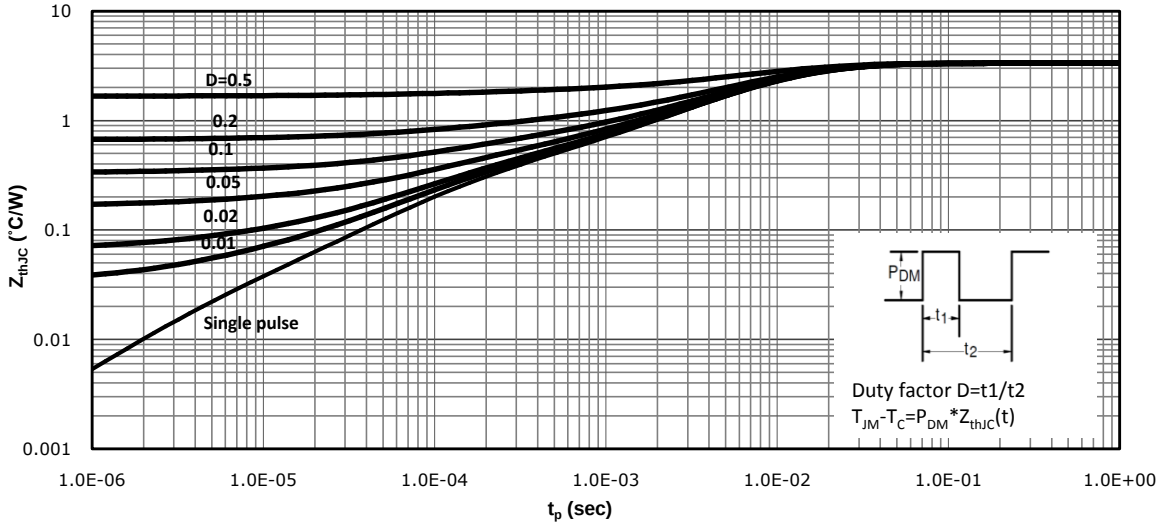



Fig 14: Max. Transient Thermal Impedance

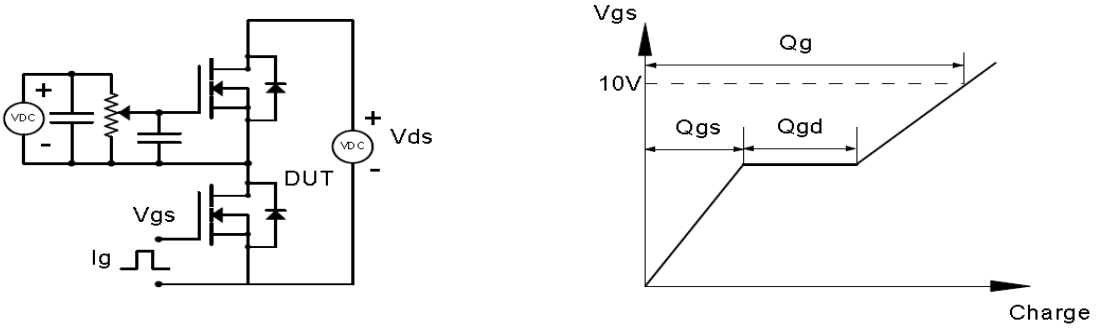




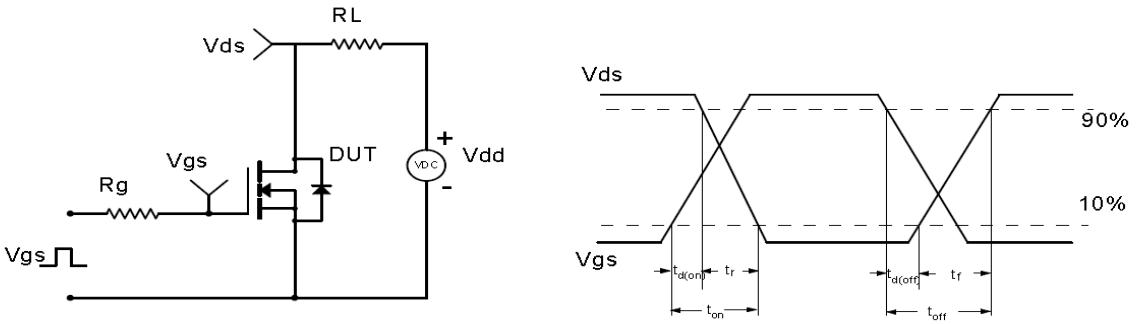
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## Test Circuit & Waveform

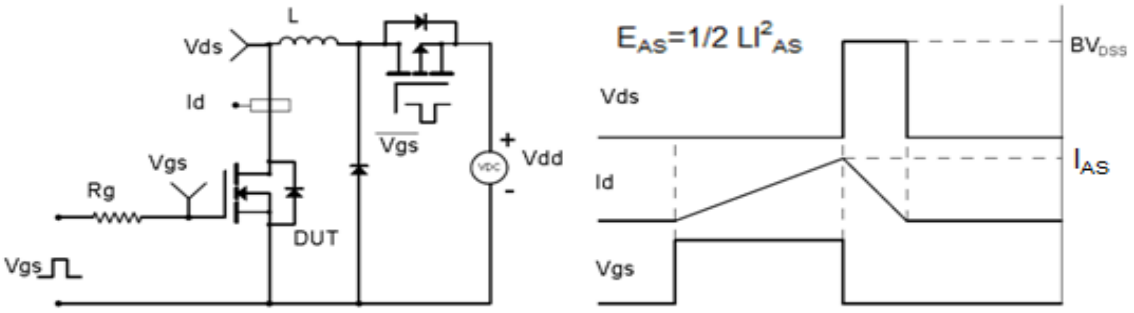
Gate Charge Test Circuit & Waveform



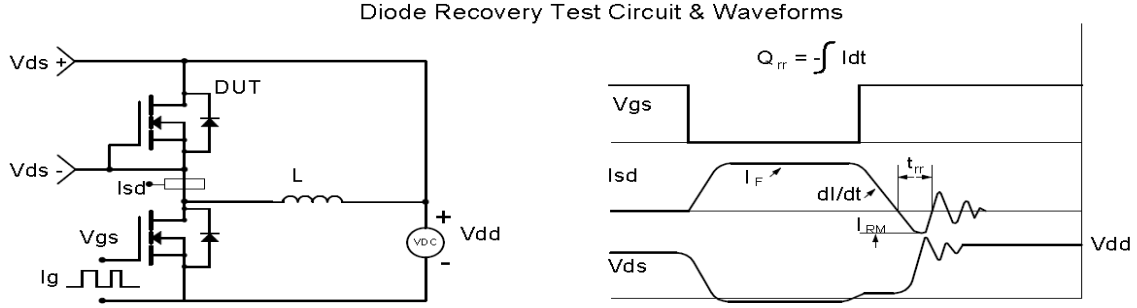

Resistive Switching Test Circuit & Waveforms




Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



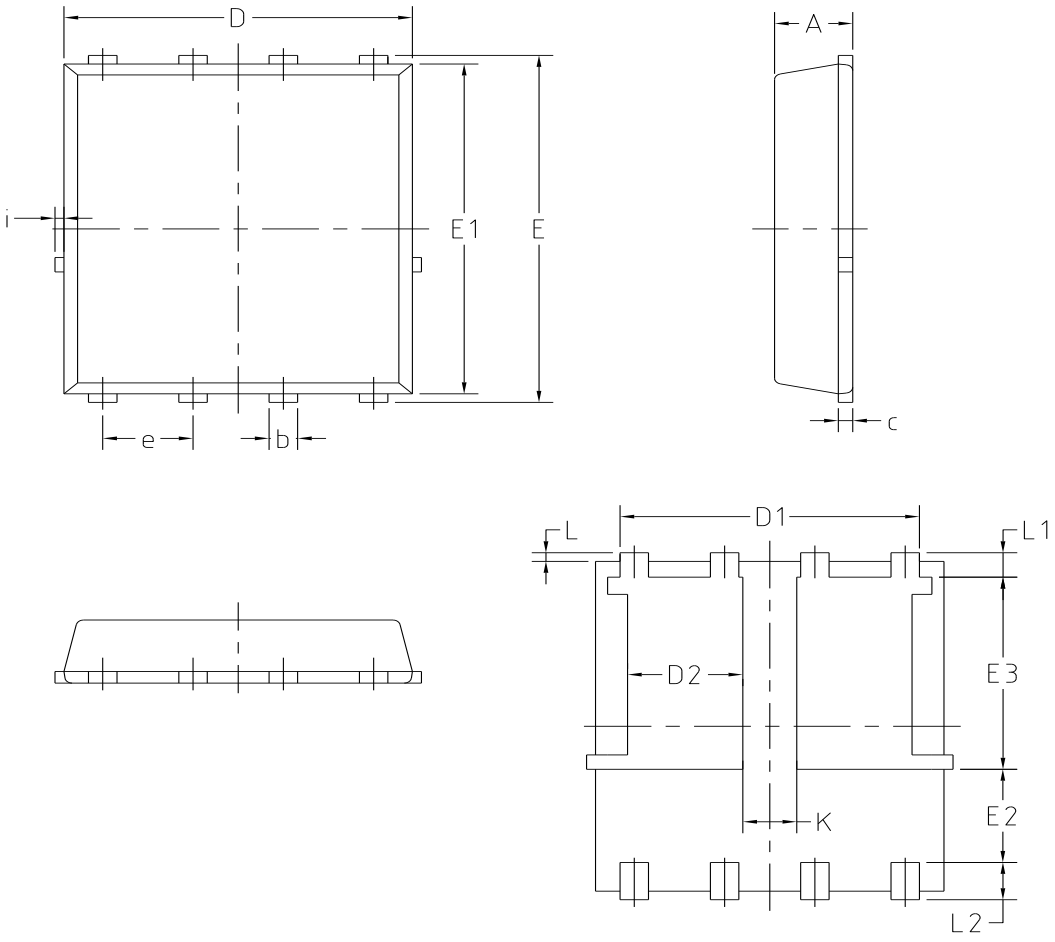

Diode Recovery Test Circuit & Waveforms





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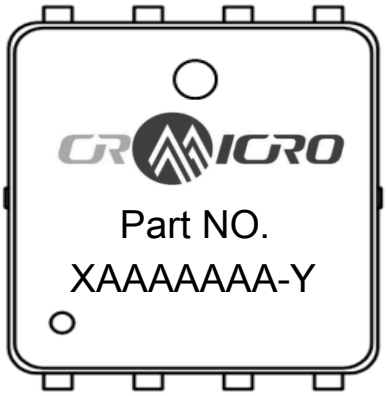
## Package Outline: PDFN5x6 Dual Pad Type 9




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.00 | 1.20 | 0.039 | 0.047 |
| b | 0.30 | 0.50 | 0.012 | 0.020 |
| c | 0.203 BSC | | 0.008 BSC | |
| D | 4.80 | 5.00 | 0.189 | 0.197 |
| D1 | 4.06 | 4.36 | 0.160 | 0.172 |
| D2 | 1.47 | 1.77 | 0.058 | 0.070 |
| E | 5.90 | 6.20 | 0.232 | 0.244 |
| E1 | 5.65 | 5.85 | 0.222 | 0.230 |
| E2 | 1.45 | - | 0.057 | - |
| E3 | 3.20 | 3.50 | 0.126 | 0.138 |
| e | 1.27 BSC | | 0.05 BSC | |
| L | 0.05 | 0.25 | 0.002 | 0.010 |
| L1 | 0.325 | 0.525 | 0.013 | 0.021 |
| L2 | 0.50 | 0.80 | 0.020 | 0.031 |
| i | - | 0.20 | - | 0.008 |
| K | 0.61 | 0.91 | 0.024 | 0.036 |


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**Marking**




NOTE:
XAAAAAAA-Y
X —Assembly location code
AAAAAAA —Assembly lot NO. last 7 digits
Y —Bin code


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## Revision History

| Revision | Date | Major changes |
|---|---|---|
| 1.0 | 2023/10/17 | Release of Preliminary version. |

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