# P-Channel  Enhancement Mode Power MOSFET

## Description

The RM40P40LD uses advanced trench technology and design to provide excellent RDS(ON) with low gate charge .This device is well suited for high current load applications.
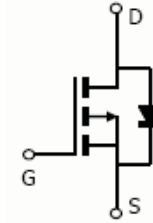
## General Features

- $V_{DS}$ =-40V, $I_D$ =-40A
  $R_{DS(ON)}$ <14mΩ @ $V_{GS}$=-10V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high $E_{AS}$
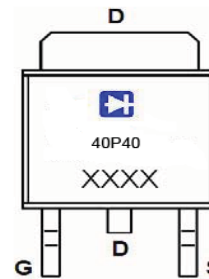- Excellent package for good heat dissipation

## Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply
- Halogen-free
- P/N suffix V means AEC-Q101 qualified, e.g:RM40P40LDV
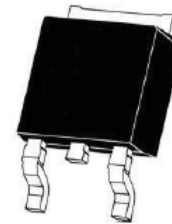
*100% UIS TESTED!*

*100% △Vds TESTED!*

**Schematic diagram**

**Marking and pin assignment**

**TO-252-2L top view**

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| 40P40 | RM40P40LD | TO-252-2L | - | - | - |

## Absolute Maximum Ratings (T$_C$=25℃unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | -40 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous | $I_D$ | -40 | A |
| Drain Current-Continuous(T$_C$=100℃) | $I_D$ (100℃) | -25 | A |
| Pulsed Drain Current | $I_{DM}$ | -50 | A |
| Maximum Power Dissipation | $P_D$ | 80 | W |
| Derating factor | | 0.53 | W/℃ |
| Single pulse avalanche energy [Note 5] | $E_{AS}$ | 544 | mJ |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 To 175 | ℃ |

## Thermal Characteristic

| Thermal Resistance,Junction-to-Case[Note 2] | $R_{\theta JC}$ | 1.88 | ℃/W |
|---|---|---|---|

## Electrical Characteristics ($T_C$=25℃ unless otherwise noted)

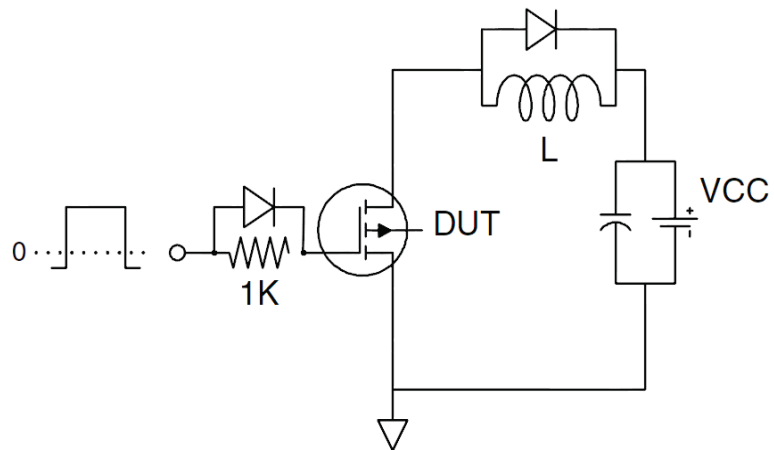| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=-250µA | -40 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-40V,$V_{GS}$=0V | - | - | -1 | µA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** [Note 3] | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=-250µA | -1.5 | -1.9 | -3.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-12A | - | 12 | 14 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-5V,$I_D$=-12A | 34 | - | - | S |
| **Dynamic Characteristics** [Note4] | | | | | | |
| Input Capacitance | $C_{Iss}$ | $V_{DS}$=-20V,$V_{GS}$=0V, F=1.0MHz | - | 2960 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 370 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 310 | - | PF |
| **Switching Characteristics** [Note 4] | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-20V,$I_D$=-20A $V_{GS}$=-10V,$R_G$=3Ω | - | 10 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 18 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 38 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 24 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-20,$I_D$=-12A, $V_{GS}$=-10V | - | 72 | | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 14 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 15 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage [Note 3] | $V_{SD}$ | $V_{GS}$=0V,$I_S$=-20A | - | | -1.2 | V |
| Diode Forward Current [Note 2] | $I_S$ | | - | - | -40 | A |
| Reverse Recovery Time | $t_{rr}$ | TJ = 25°C, IF =- 20A di/dt = -100A/µs[Note3] | - | 40 | | nS |
| Reverse Recovery Charge | Qrr | | - | 42 | | nC |
| Forward Turn-On Time | $t_{on}$ | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

## Notes:

**1.** Repetitive Rating: Pulse width limited by maximum junction temperature.

**2.** Surface Mounted on FR4 Board, t ≤ 10 sec.

**3.** Pulse Test: Pulse Width ≤ 300µs, Duty Cycle ≤ 2%.

**4.** Guaranteed by design, not subject to production

**5.** $E_{AS}$ condition: Tj=25℃,$V_{DD}$=-20V,$V_G$=-10V,L=1mH,Rg=25Ω,$I_{AS}$=33A
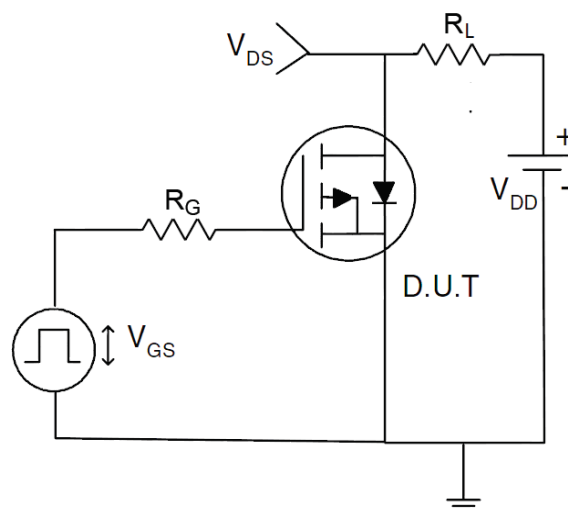
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## Test Circuit
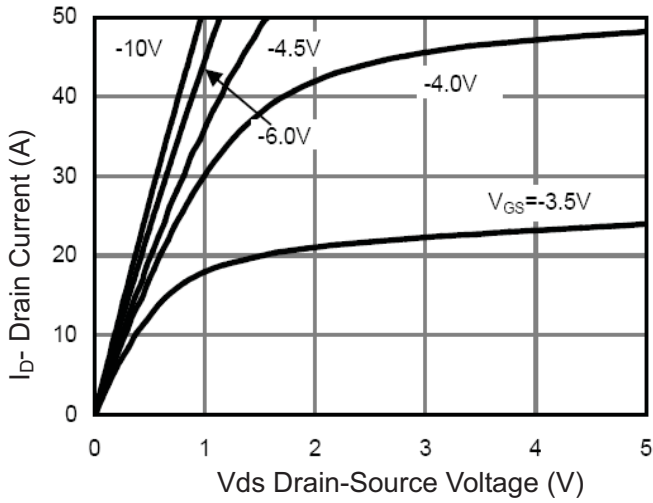
### 1) E$_{AS}$ Test Circuit
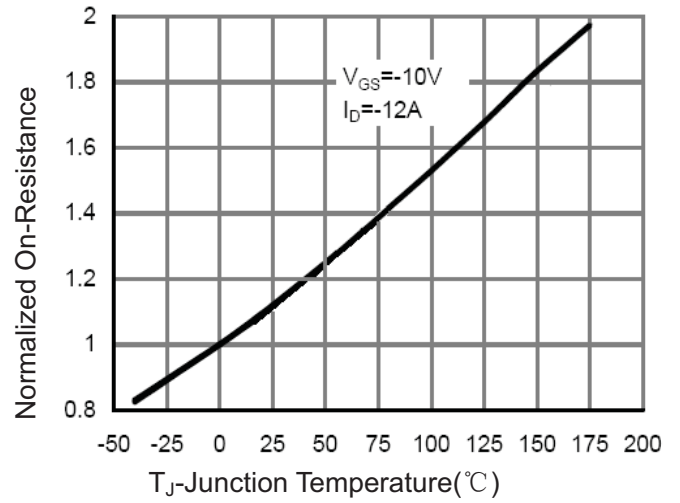


### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



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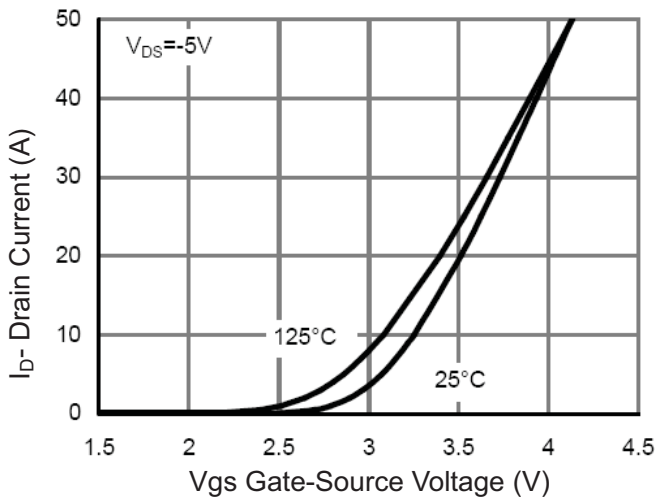# RATING AND CHARACTERISTICS CURVES (RM40P40LD)
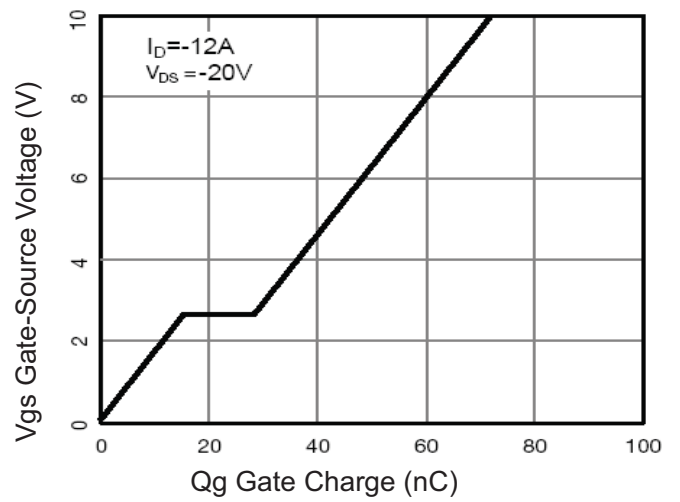


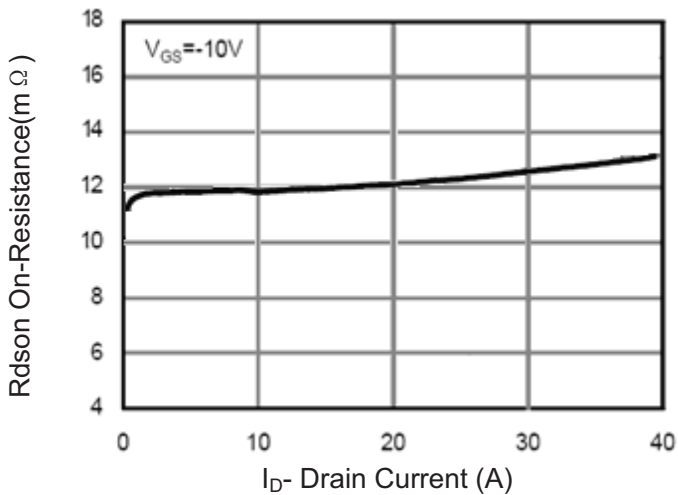**Figure 1 Output Characteristics**



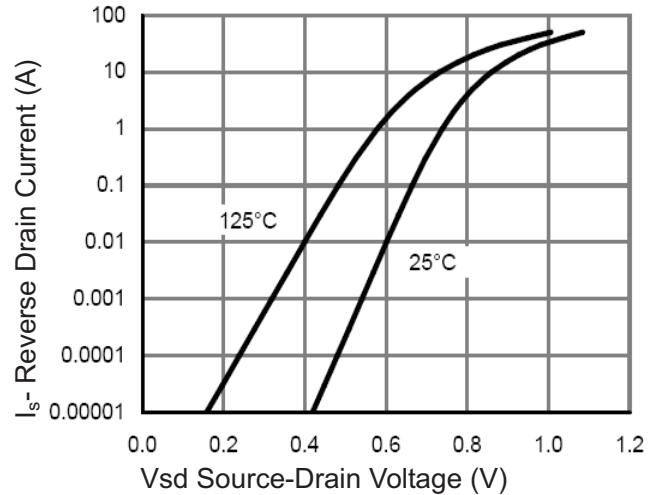**Figure 4 Rdson-Junction Temperature**



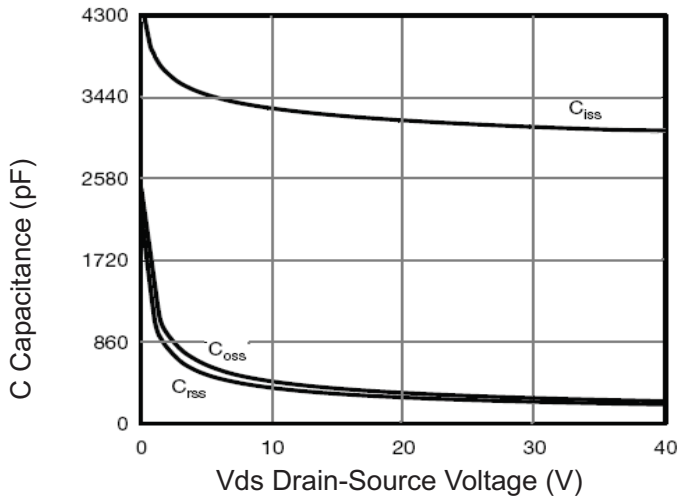**Figure 2 Transfer Characteristics**



**Figure 5 Gate Charge**



**Figure 3 Rdson- Drain Current**
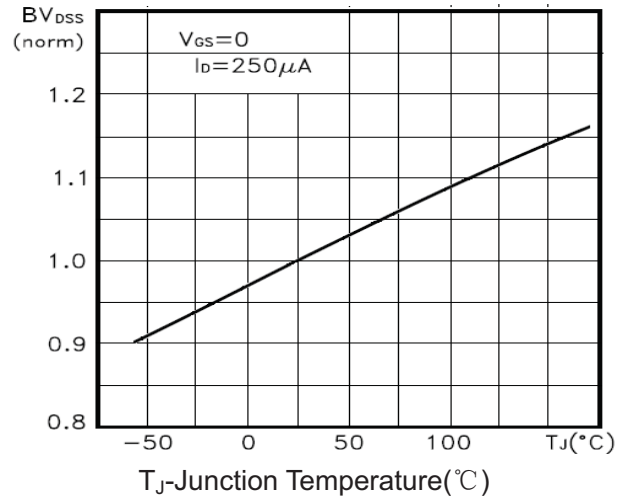


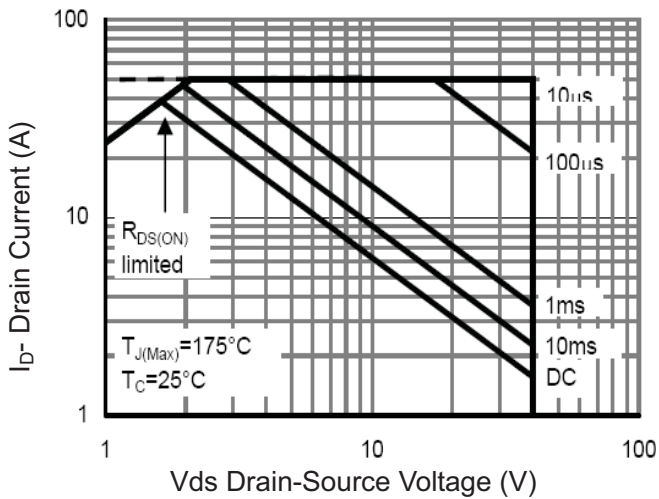**Figure 6 Source- Drain Diode Forward**

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# RATING AND CHARACTERISTICS CURVES (RM40P40LD)



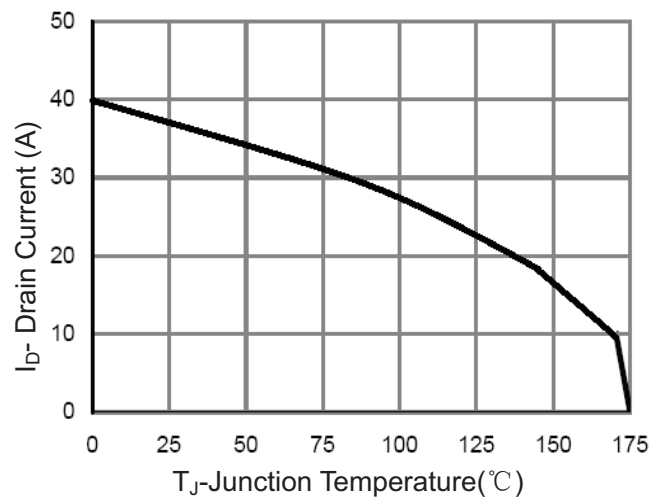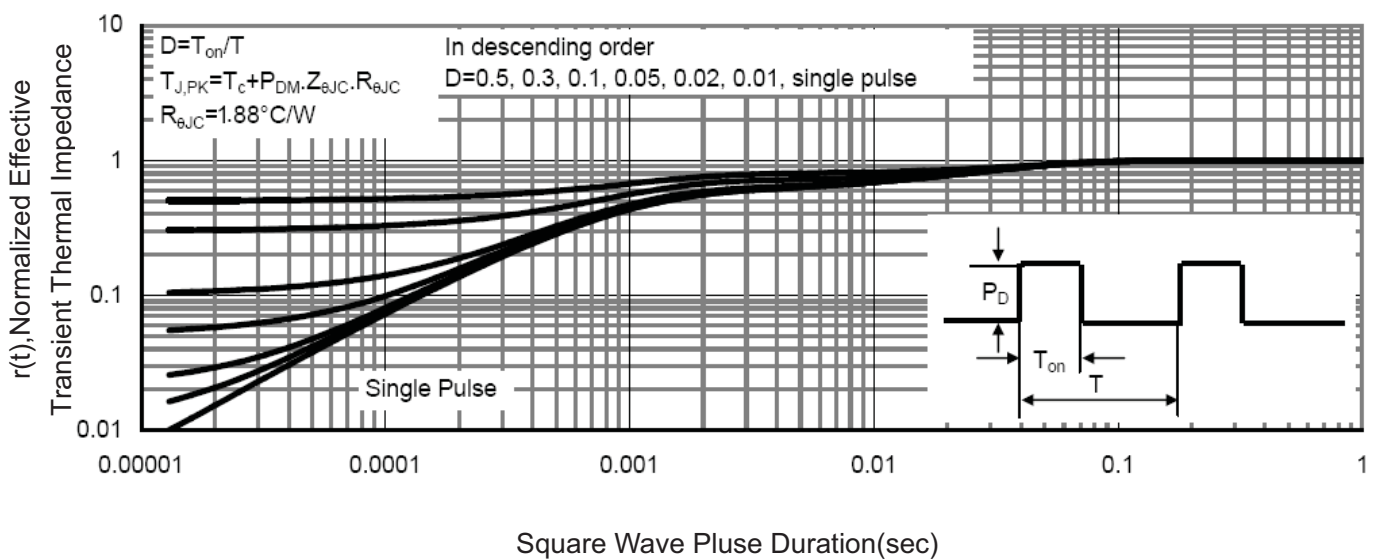**Figure 7 Capacitance vs Vds**



**Figure 9 BV$_{DSS}$ vs Junction Temperature**
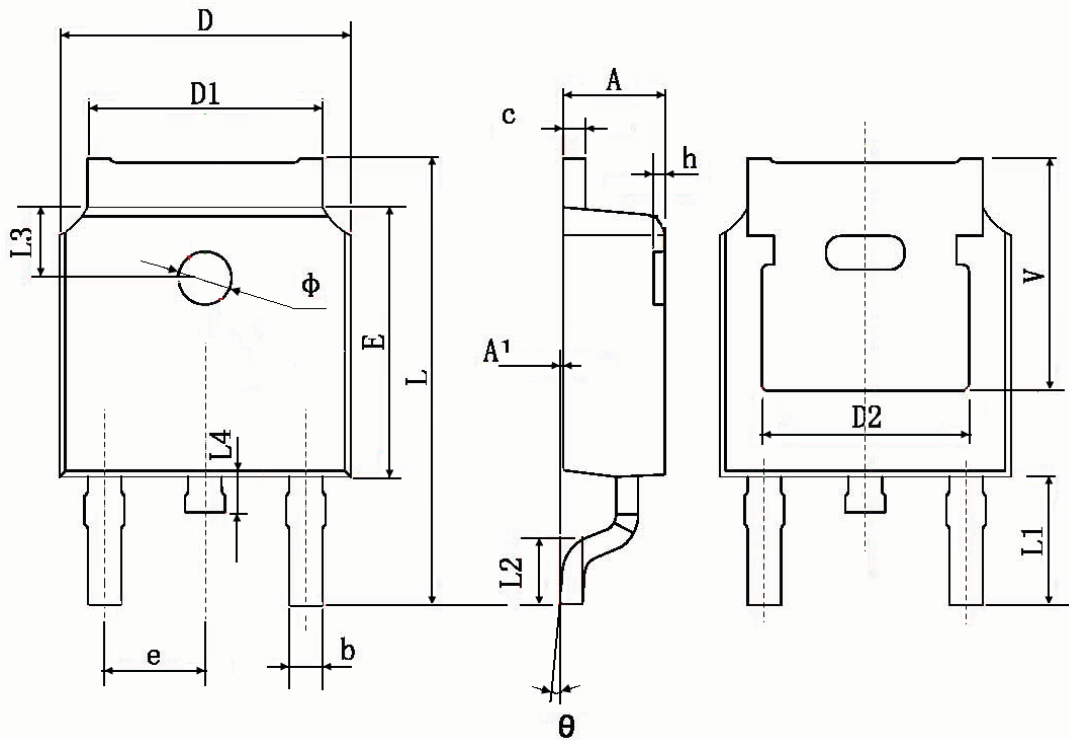


**Figure 8 Safe Operation Area**



**Figure 10 ID Current Derating vs Junction Temperature**



Square Wave Pluse Duration(sec)

**Figure 11 Normalized Maximum Transient Thermal Impedance**

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## TO-252 Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------|------|------|------|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.660 | 0.860 | 0.026 | 0.034 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 4.830 TYP. | | 0.190 TYP. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.800 | 10.400 | 0.386 | 0.409 |
| L1 | 2.900 TYP. | | 0.114 TYP. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 TYP. | | 0.063 TYP. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| Φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 TYP. | | 0.211 TYP. | |

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| Package | Tube (pcs/tube) | Tube (pcs/inner box) | Tube (pcs/cartoon) | Tape&Reel (pcs/reel) | Tape&Reel (pcs/inner box) | Tape&Reel (pcs/cartoon) |
|---|---|---|---|---|---|---|
| DFN5x6/DFN3x3 | 100 | 10,000 | 100,000 | 2,500 | 5,000 | 40,000 |
| DFN1006 | —— | —— | —— | 10,000 | 10,000 | 400,000 |
| SOP-8 | 100 | 10,000 | 100,000 | 4,000 | 4,000 | 20,000 |
| TSSOP-8 | 100 | 32,000 | 128,000 | 3,000 | 6,000 | 48,000 |
| SOT-23-3L | —— | —— | —— | 3,000 | 30,000 | 120,000 |
| SOT-23-6L | —— | —— | —— | 3,000 | 30,000 | 120,000 |
| SOT-23(6R) | —— | —— | —— | 3,000 | 30,000 | 120,000 |
| SOT-363 | —— | —— | —— | 3,000 | 30,000 | 120,000 |
| SOT-523 | —— | —— | —— | 3,000 | 30,000 | 120,000 |
| SOT223 | —— | —— | —— | 2,500 | 2,500 | 20,000 |
| TO-220 | 50 | 1,000 | 5,000 | —— | —— | —— |
| TO-220F | 50 | 1,000 | 10,000 | —— | —— | —— |
| TO-247 | 30 | 300 | 1,200 | —— | —— | —— |
| TO-251 | 80 | 4,000 | 40,000 | —— | —— | —— |
| TO-251S(4R) | 80 | 4,000 | 40,000 | —— | —— | —— |
| TO-252-2L(4R) | 80 | 4,000 | 40,000 | 2,500 | 2,500 | 25,000 |
| TO-263-2L | 50 | 1,000 | 10,000 | 800 | 800 | 8,000 |
| TO-3P | 30 | 300 | 3,000 | —— | —— | —— |
| TO-92 | —— | —— | —— | 1,000(袋装) | 10,000 | 100,000 |

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