

N-Channel Enhancement Mode Power MOSFET

DESCRIPTION

The HM60N03K uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

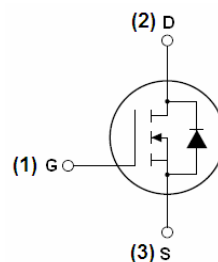
GENERAL FEATURES

- $V_{DS} = 30V, I_D = 60A$
 $R_{DS(ON)} < 11m\Omega @ V_{GS} = 10V$
 $R_{DS(ON)} < 13m\Omega @ V_{GS} = 4.5V$
- High density cell design for ultra low R_{dson}
- Fully characterized Avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

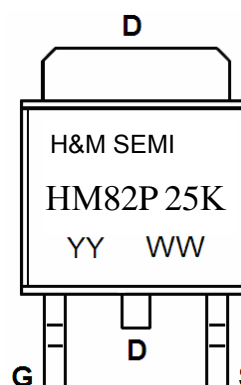
Application

- Power switching application
- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply

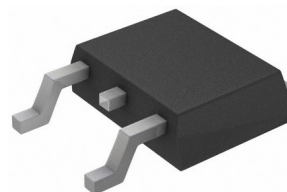
100% UIS TESTED!



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 |
|----------------|----------|----------------|-----------|------------|----------|
| HM60N03K | HM60N03K | TO-252-2L | | - | - |

Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|--|--------------------|------------|------|
| Drain-Source Voltage | V_{DS} | 30 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | V |
| Drain Current-Continuous | I_D | 60 | A |
| Drain Current-Continuous($T_C = 100^\circ C$) | $I_D(100^\circ C)$ | 42 | A |
| Pulsed Drain Current | I_{DM} | 180 | A |
| Maximum Power Dissipation | P_D | 60 | W |
| Derating factor | | 0.4 | W/°C |
| Single pulse avalanche energy (Note 5) | E_{AS} | 70 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 175 | °C |

Thermal Characteristic

| | | | |
|--|-----------------|-----|----------------------|
| Thermal Resistance, Junction-to-Case(Note 2) | $R_{\theta JC}$ | 2.5 | $^{\circ}\text{C/W}$ |
|--|-----------------|-----|----------------------|

Electrical Characteristics (TA=25 $^{\circ}\text{C}$ unless otherwise noted)

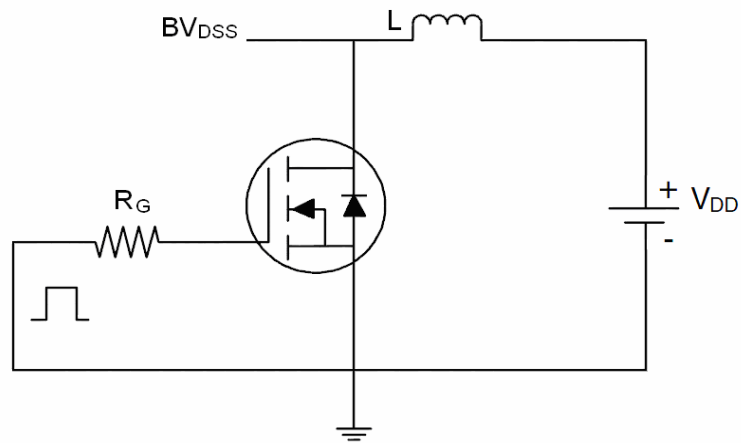
| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|--------------|---|-----|------|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 30 | 33 | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=30V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1 | 1.8 | 3 | V |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=25A$ | - | 9 | 11 | m Ω |
| | | $V_{GS}=5V, I_D=20A$ | - | 11 | 13 | |
| Forward Transconductance | g_{FS} | $V_{DS}=5V, I_D=20A$ | 15 | - | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=15V, V_{GS}=0V,$ $F=1.0\text{MHz}$ | - | 2000 | - | PF |
| Output Capacitance | C_{oss} | | - | 280 | - | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 160 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=15V, I_D=20A$ $V_{GS}=10V, R_{GEN}=1.8\Omega$ | - | 10 | - | nS |
| Turn-on Rise Time | t_r | | - | 8 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 30 | - | nS |
| Turn-Off Fall Time | t_f | | - | 5 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=10V, I_D=25A,$ $V_{GS}=10V$ | - | 23 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 7 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 4.5 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V_{SD} | $V_{GS}=0V, I_S=25A$ | - | 0.85 | 1.2 | V |
| Diode Forward Current (Note 2) | I_S | | - | - | 40 | A |
| Reverse Recovery Time | t_{rr} | $T_J = 25^{\circ}\text{C}, I_F = 40A$ $di/dt = 100A/\mu s(\text{Note}3)$ | - | 22 | 35 | nS |
| Reverse Recovery Charge | Q_{rr} | | - | 12 | 20 | nC |
| Forward Turn-On Time | t_{on} | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

Notes:

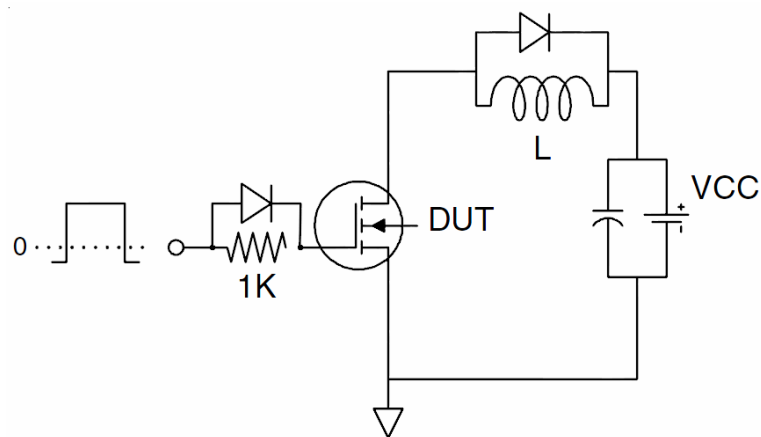
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition: $T_j=25^{\circ}\text{C}, V_{DD}=15V, V_G=10V, L=1\text{mH}, R_g=25\Omega$

Test circuit

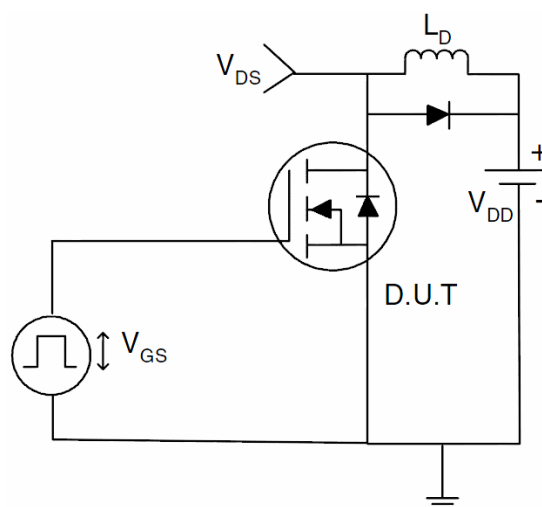
1) E_{AS} test Circuits



2) Gate charge test Circuit:



3) Switch Time Test Circuit:



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

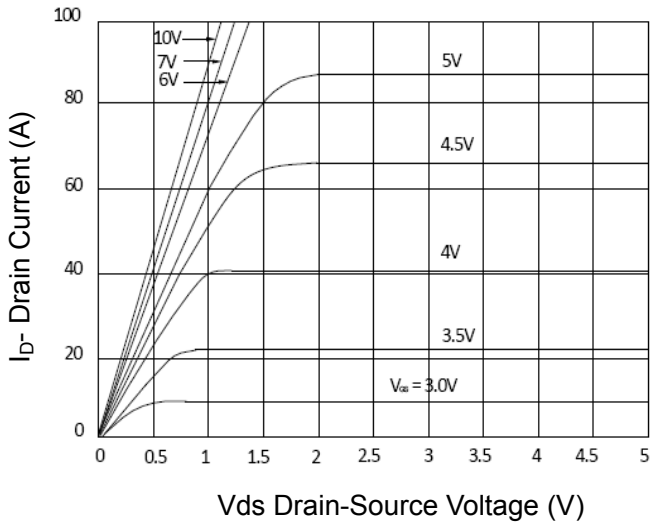


Figure 1 Output Characteristics

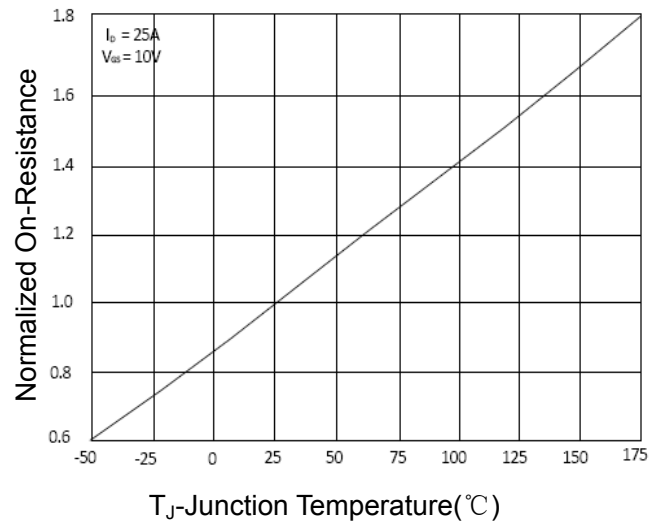


Figure 4 R_{dson} -Junction Temperature

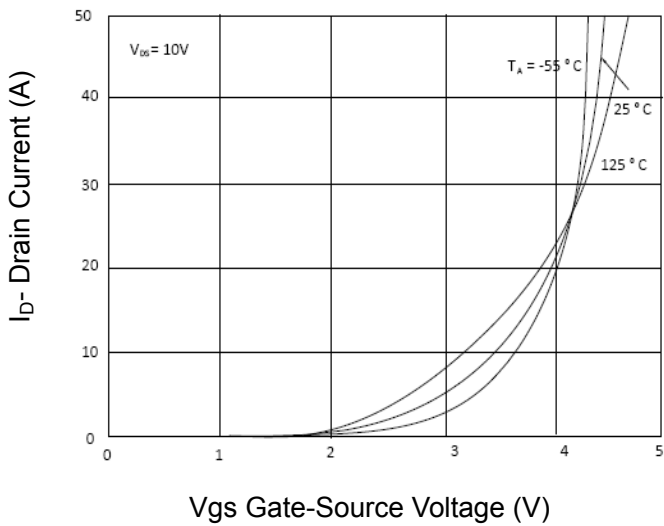


Figure 2 Transfer Characteristics

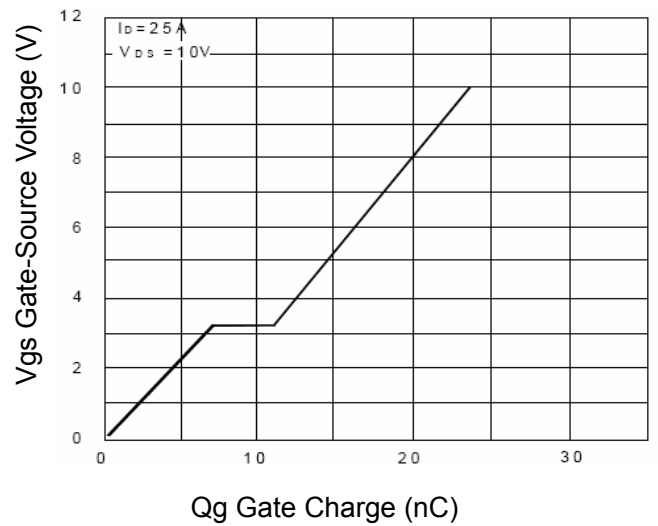


Figure 5 Gate Charge

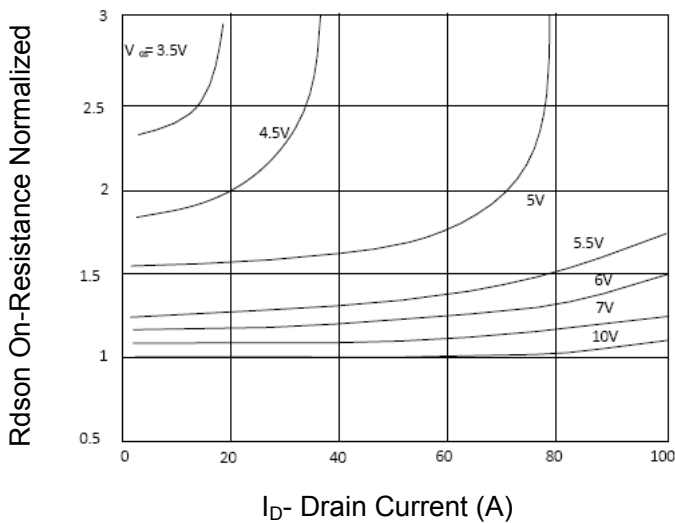


Figure 3 R_{dson} - Drain Current

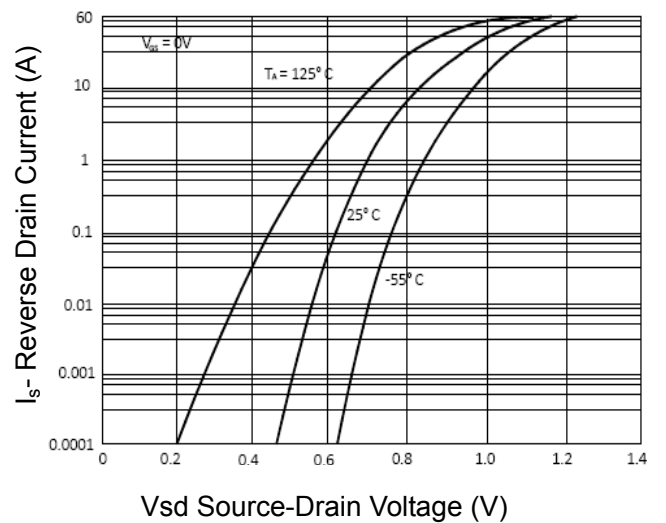
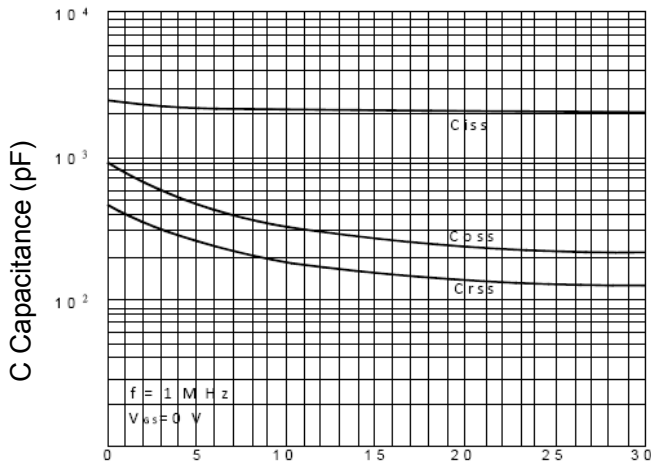
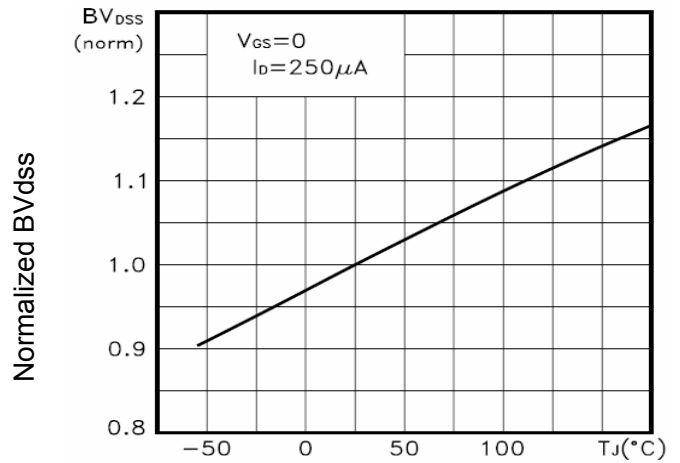


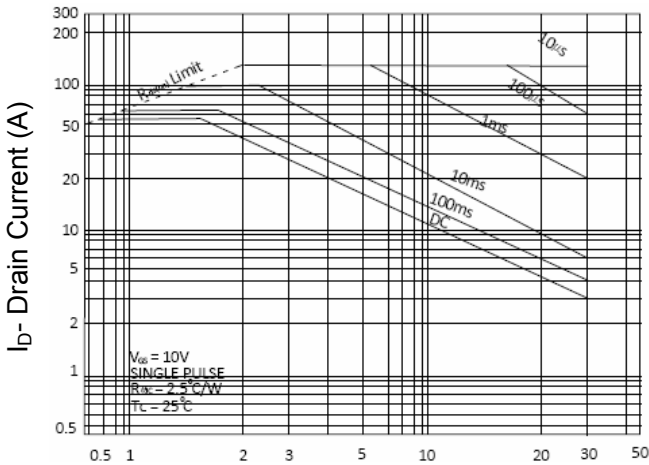
Figure 6 Source- Drain Diode Forward



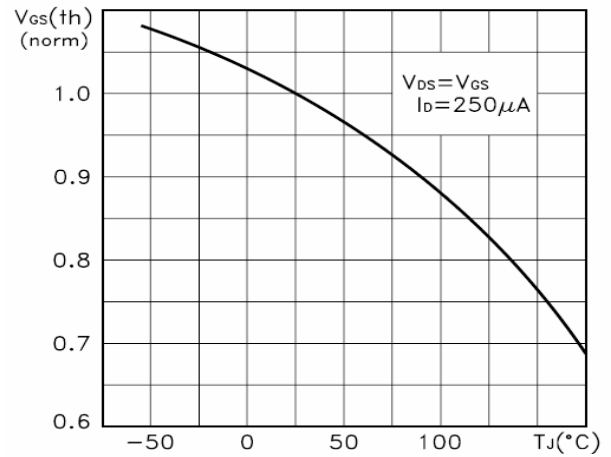
Vds Drain-Source Voltage (V)
Figure 7 Capacitance vs Vds



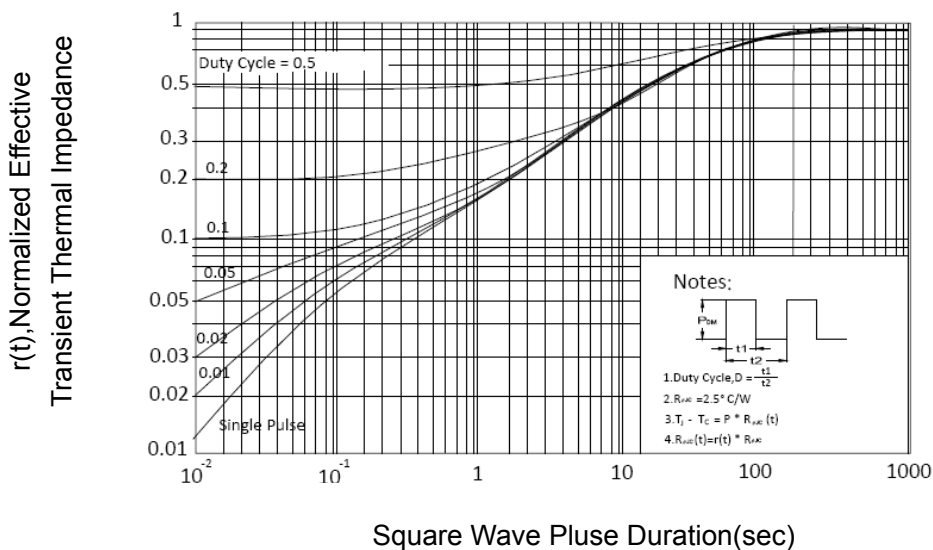
T_J-Junction Temperature(°C)
Figure 9 BV_{DSS} vs Junction Temperature



Vds Drain-Source Voltage (V)
Figure 8 Safe Operation Area

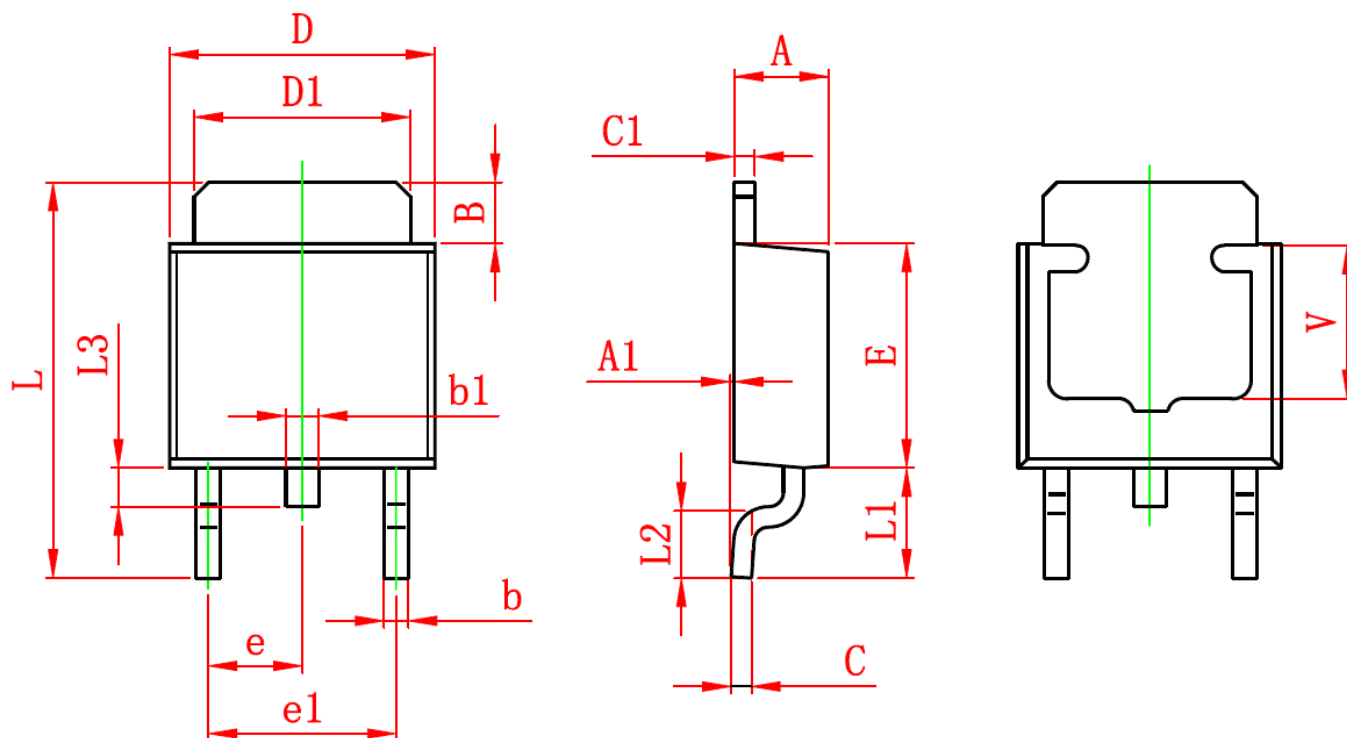


T_J-Junction Temperature(°C)
Figure 10 V_{GS(th)} vs Junction Temperature



Square Wave Pluse Duration(sec)
Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252-2L 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 | 1.350 | 1.650 | 0.053 | 0.065 |
| b | 0.500 | 0.700 | 0.020 | 0.028 |
| b1 | 0.700 | 0.900 | 0.028 | 0.035 |
| c | 0.430 | 0.580 | 0.017 | 0.023 |
| c1 | 0.430 | 0.580 | 0.017 | 0.023 |
| D | 6.350 | 6.650 | 0.250 | 0.262 |
| D1 | 5.200 | 5.400 | 0.205 | 0.213 |
| E | 5.400 | 5.700 | 0.213 | 0.224 |
| e | 2.300 TYP. | | 0.091 TYP. | |
| e1 | 4.500 | 4.700 | 0.177 | 0.185 |
| L | 9.500 | 9.900 | 0.374 | 0.390 |
| L1 | 2.550 | 2.900 | 0.100 | 0.114 |
| L2 | 1.400 | 1.780 | 0.055 | 0.070 |
| L3 | 0.600 | 0.900 | 0.024 | 0.035 |
| V | 3.800 REF. | | 0.150 REF. | |

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