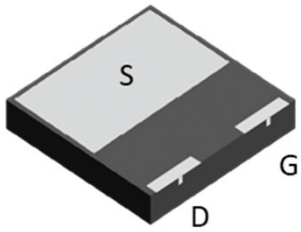
Prisemi®

# PGC8FN65R70B

## 650V GaN Power Transistor

## Description

| Product Summary | | |
|---|---|---|
| $V_{DS}$(V) | $R_{DS(on)}$(mΩ)(Typ) | $I_D$(A) |
| 650 | 70@ $V_{GS}$ = 12V | 21 |



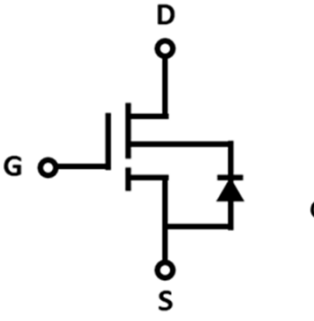

DFN8080-3L (Bottom View)

## Feature

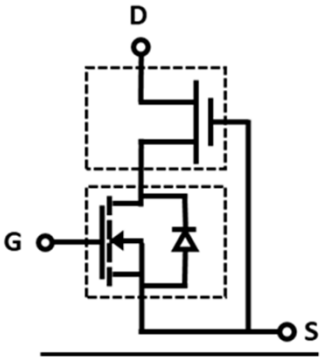
- Easy to use, compatible with standard gate drivers
- Excellent $Q_G$ x $R_{DS(on)}$ figure of merit (FOM)
- Low $Q_{RR}$, no free-wheeling diode required
- Low switching loss
- RoHS compliant and Halogen-free

## Applications

- High efficiency power supplies
- Telecom and datacom
- Automotive
- Servo motors




Schematic Symbol




Cascode Device Structure

## Absolute maximum rating@25℃

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 650 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Transient Drain-Source Voltage[1)] | | $V_{TDS}$ | 800 | V |
| Continuous Drain Current | $T_C$=25℃ | $I_D$ | 21 | A |
| | $T_C$=100℃ | | 13 | |
| Pulsed Drain Current (Pulse Width: 100μs) | $T_C$=25℃ | $I_{DM}$ | 107 | A |
| | $T_C$=100℃ | | 82 | |
| Power Dissipation | | $P_D$ | 60 | W |
| Soldering Peak Temperature | | $T_{CSOLD}$ | 260 | ℃ |
| Operating Junction and Storage Temperature | | $T_J$, $T_{STG}$ | -55 to 150 | ℃ |

## Thermal Resistance

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | - | 2.1 | - | ℃/W |
| Thermal Resistance, Junction-to-Ambient[2)] | $R_{\theta JA}$ | - | 50 | - | ℃/W |

## Electrical characteristics per line@25℃ (unless otherwise specified)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| **Statistic Characteristics** | | | | | | | |
| Maximum Drain-Source Voltage | $V_{DS-Max}$ | $V_{GS}$ = 0V | | 650 | - | - | V |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ = 0V,$I_D$ = 250μA | | - | 1000 | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=700V, $V_{GS}$=0V | $T_J$=25℃ | - | 8.0 | 20 | μA |
| | | | $T_J$=150℃ | - | 50 | - | |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±20V,$V_{DS}$ = 0V | | - | - | ±150 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$,$I_D$ = 500μA | | 3.0 | 4.0 | 5.0 | V |
| Gate Threshold Voltage Temperature Coefficient | $\triangle V_{GS(th)}/T_J$ | | | - | -10.7 | - | mV/℃ |
| Drain-Source On-State Resistance[3)] | $R_{DS(ON)}$ | $V_{GS}$=12V, $I_D$=4A | $T_J$=25℃ | - | 70 | 90 | mΩ |
| | | | $T_J$=150℃ | - | 140 | - | |
| **Dynamic Characteristics** | | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$ = 400V,$V_{GS}$ = 0V, f = 1MHz | | - | 540 | - | pF |
| Output Capacitance | $C_{oss}$ | | | - | 77 | - | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | - | 3.0 | - | |
| Effective Output Capacitance, Energy Related | $C_{o(er)}$ | $V_{GS}$ = 0V, $V_{DS}$ = 0-400V | | - | 115 | - | pF |
| Effective Output Capacitance, Time Related | $C_{o(tr)}$ | | | - | 210 | - | |
| Output Charge | $Q_{oss}$ | | | - | 84 | - | nC |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DS}$ = 400V,$I_D$ = 10A, $V_{GS}$ =0-12V,$R_G$=47Ω | | - | 30 | - | ns |
| Turn-on Rise Time | $t_r$ | | | - | 16 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | - | 80 | - | |
| Turn-Off Fall Time | $t_f$ | | | - | 10 | - | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = 400V,$I_D$ = 13A, $V_{GS}$ =0-12V | | - | 15 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | | - | 4.6 | - | |
| Gate-Drain Charge | $Q_{gd}$ | | | - | 5.6 | - | |
| **Reverse Diode Characteristics** | | | | | | | |
| Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V, $I_S$=7A | | - | 1.2 | - | V |
| | | $V_{GS}$=0V, $I_S$=13A | $T_J$=25℃ | - | 1.5 | - | |
| | | | $T_J$=150℃ | - | 2.0 | - | |
| Reverse Recovery Time | $t_{rr}$ | $V_{GS}$=0V, $I_S$=13A, $V_{DD}$=400V, di/dt=1000A/μs | | - | 33 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | - | 84 | - | nC |

Notes:
1. Off-state spike duty cycle < 0.01, spike duration < 2μs
2. Device on one layer epoxy PCB for drain connection (vertical and without air stream cooling, with 6cm²copper area and 70μm thickness)
3. Dynamic on-resistance; see Figure 18 and 19 for test circuit and configurations

## Typical Characteristics

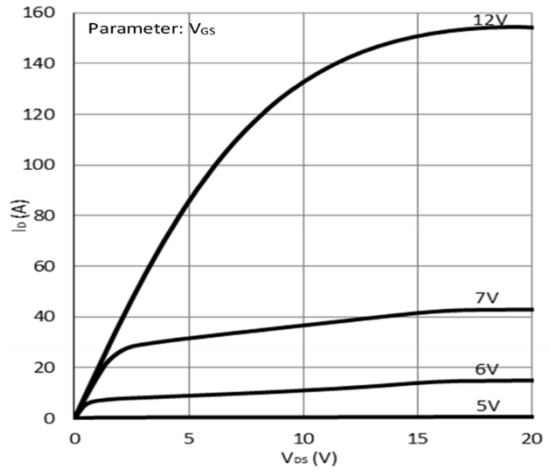



Figure 1. Typical Output Characteristics $T_J$=25℃

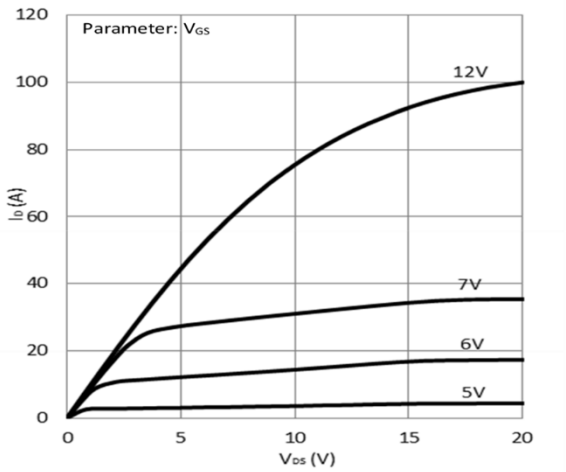



Figure 2. Typical Output Characteristics $T_J$=150℃

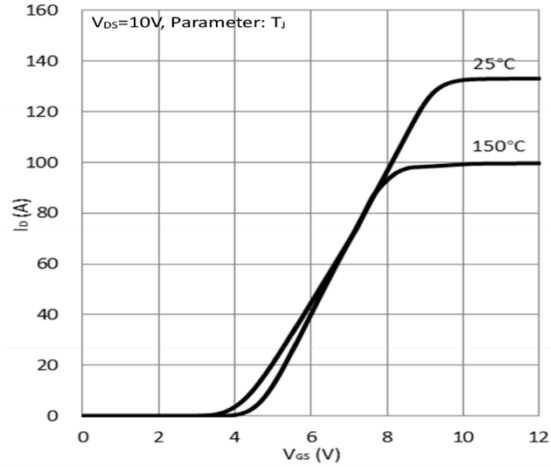



Figure 3. Typical Transfer Characteristics

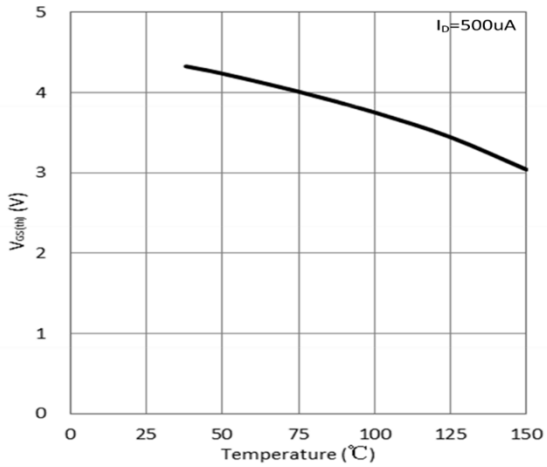



Figure 4. $V_{GS(th)}$ Vs Temperature Characteristics

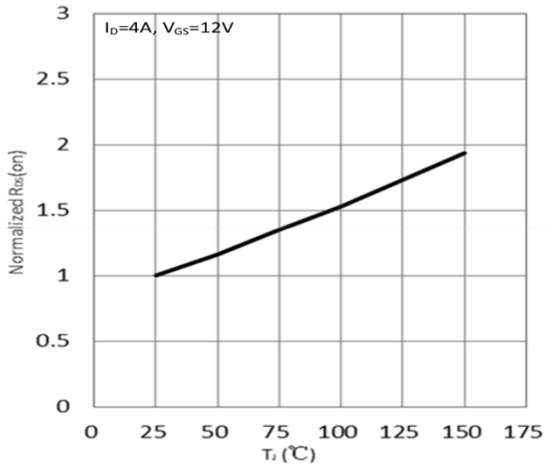



Figure 5. Normalized On-resistance

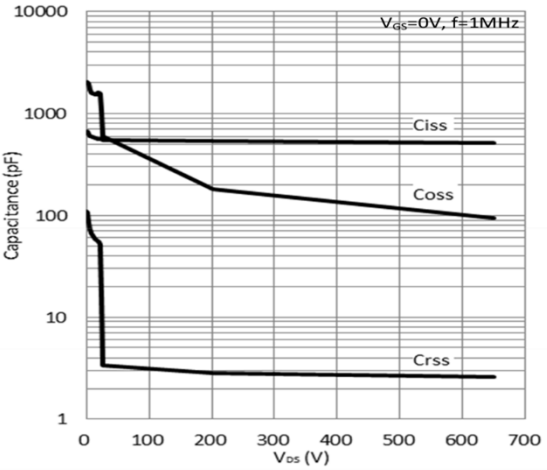



Figure 6. Typical Capacitance

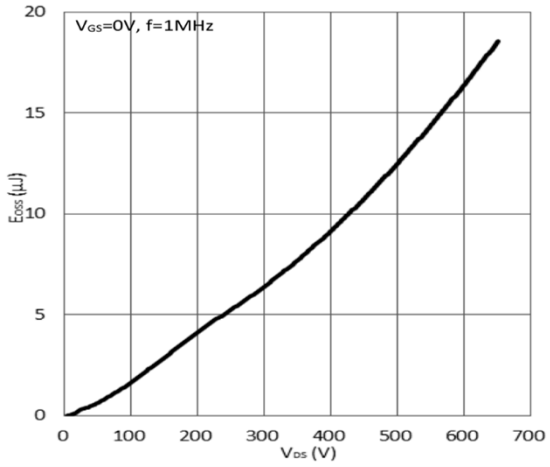



Figure 7. Typical Coss Stored Energy

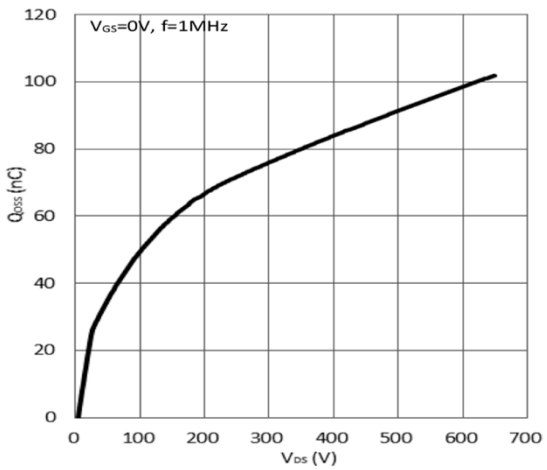



Figure 8. Typical Qoss

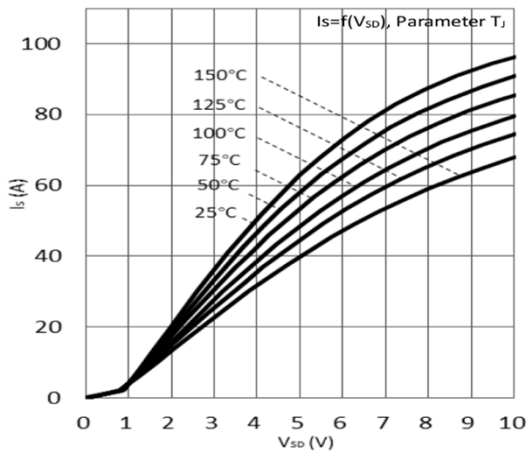



Figure 9. Forward Characteristic of Rev. Diode

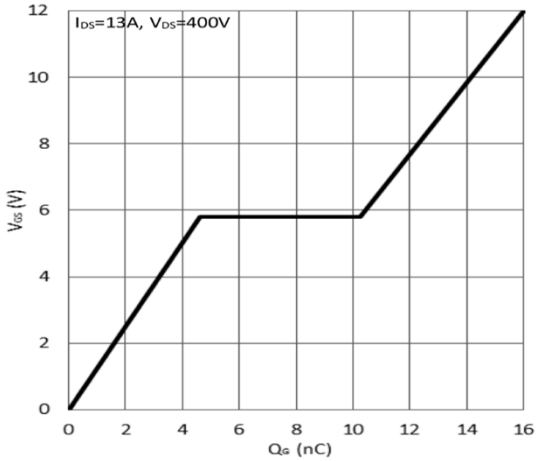



Figure 10. Typical Gate Charge

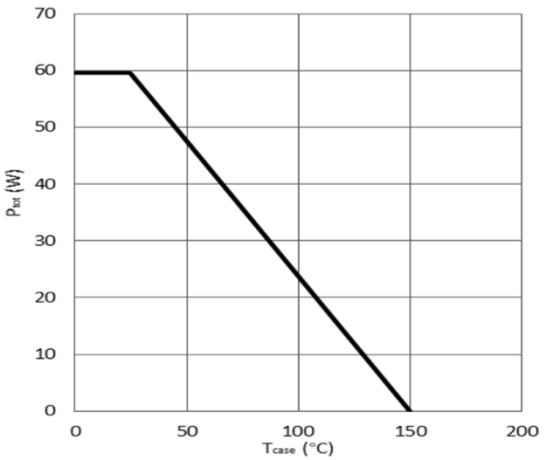



Figure 11. Power Dissipation

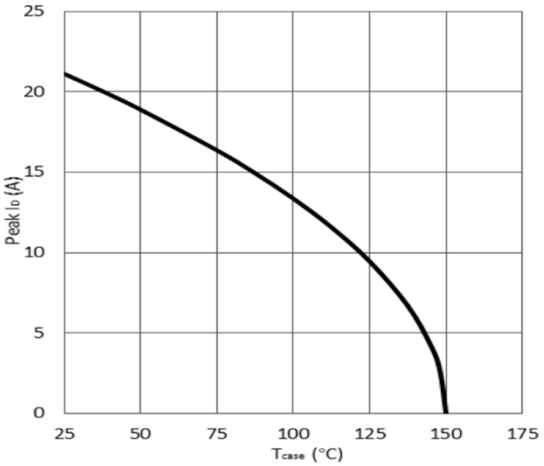



Figure 12. Current Derating

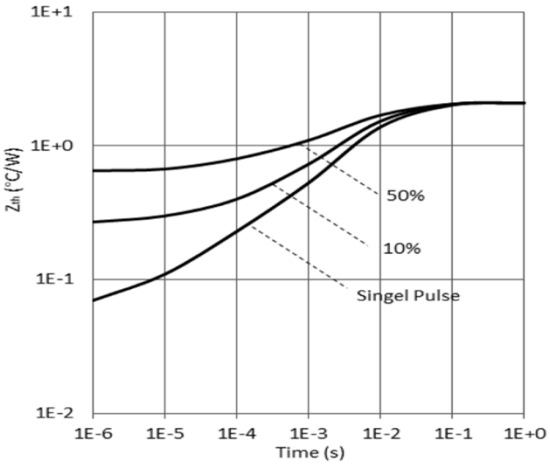



Figure 13. Transient Thermal Resistance

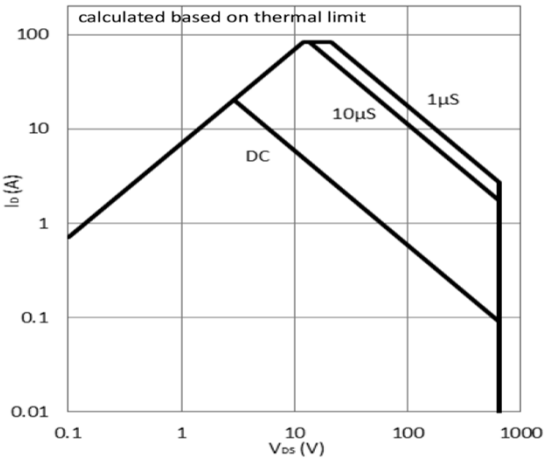



Figure 14. Safe Operating Area $T_C$=25℃

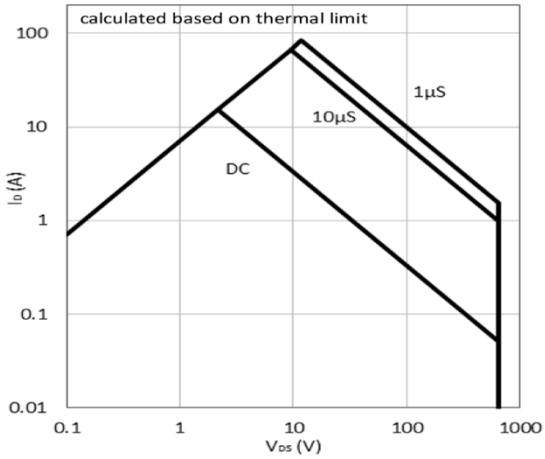



Figure 15. Safe Operating Area $T_C$=80℃

## Test Circuits and Waveforms

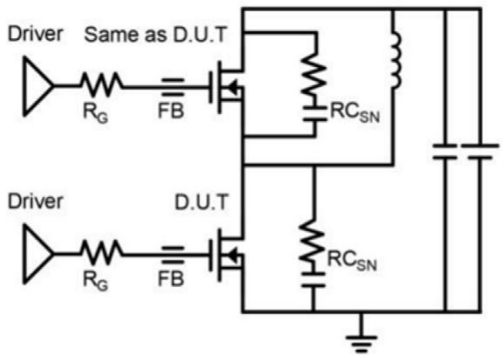



Figure 16. Switching Time Test Circuit

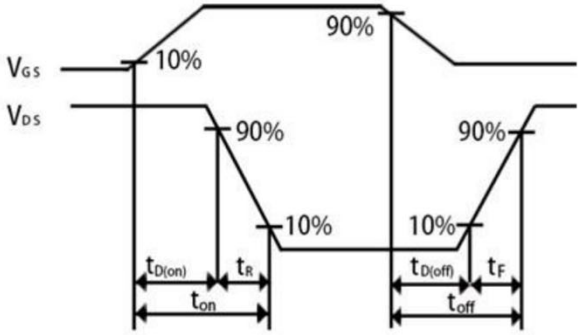



Figure 17. Switching Time Waveform

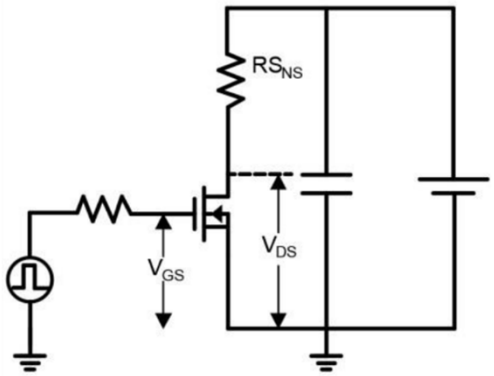



Figure 18. Dynamic $R_{DS(on)}$ Test Circuit

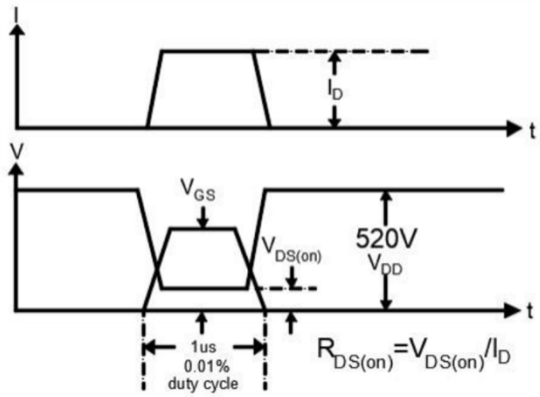



Figure 19. Dynamic $R_{DS(on)}$ Waveform

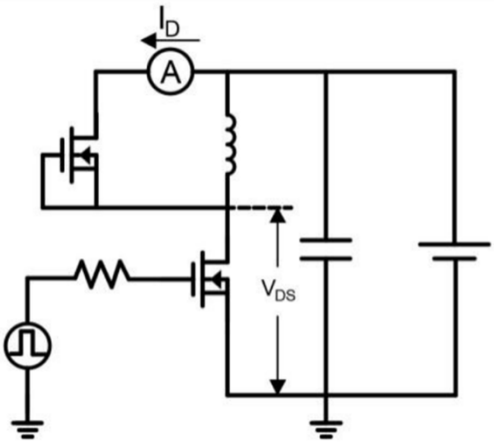



Figure 20. Diode Characteristic Test Circuits

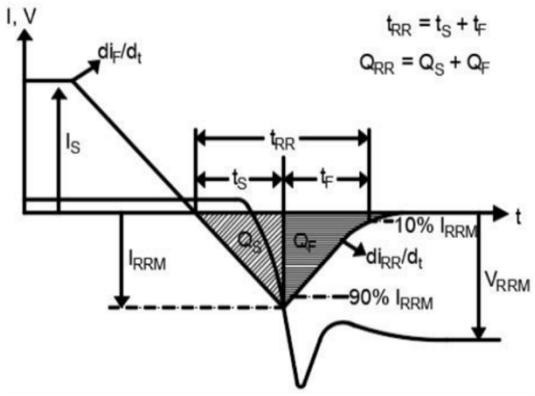
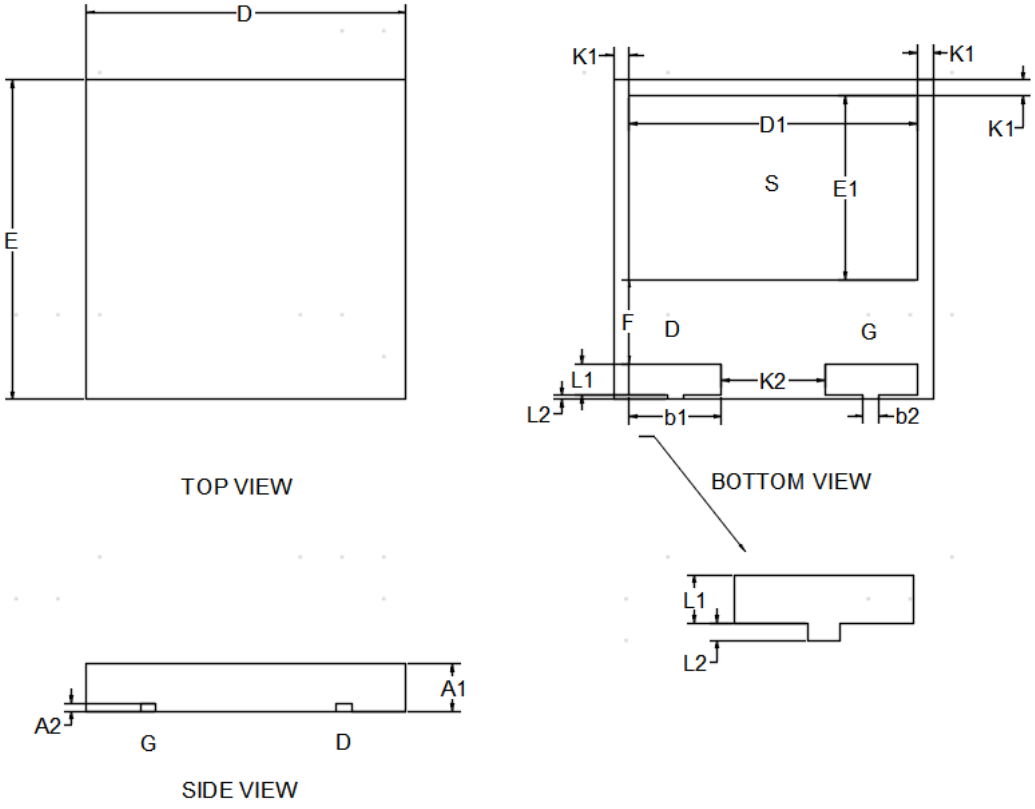



Figure 21. Diode Recovery Waveform

## Product Dimension (DFN8080-3L)




| SYMBOL | Millimeter | | |
|---|---|---|---|
| | Min | Nom | Max |
| A1 | 0.80 | 0.90 | 1.15 |
| A2 | 0.19 | 0.203 | 0.22 |
| b1 | 2.20 | 2.30 | 2.40 |
| b2 | | 0.80REF | |
| D | 7.90 | 8.00 | 8.10 |
| E | 7.90 | 8.00 | 8.10 |
| D1 | 6.90 | 7.20 | 7.50 |
| E1 | 4.40 | 4.60 | 4.80 |
| L1 | 0.70 | 0.80 | 0.90 |
| L2 | | 0.12REF | |
| K1 | 0.30 | 0.40 | 0.50 |
| K2 | 2.50 | 2.60 | 2.70 |
| F | 2.05 | 2.15 | 2.35 |

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