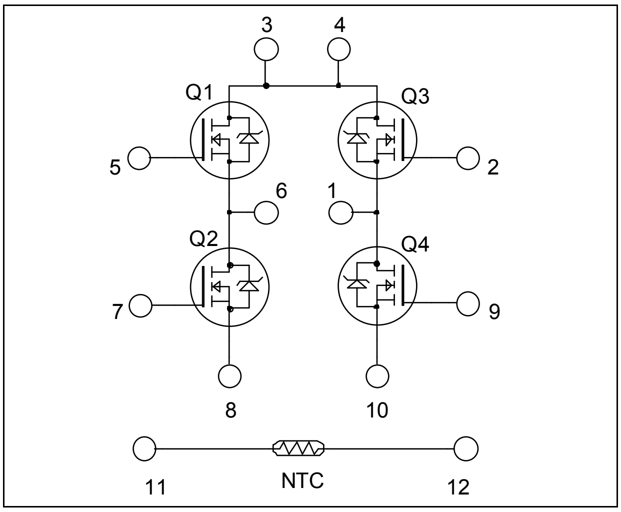
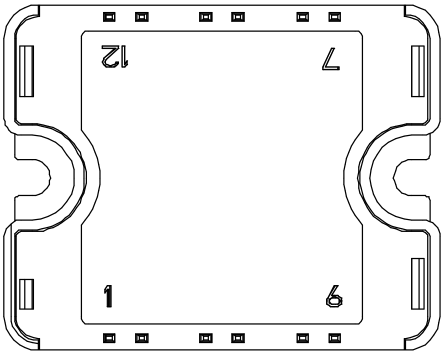
# APTC80H15T1G

Microsemi
POWER PRODUCTS GROUP

## *Full - Bridge*
## *Super Junction MOSFET*
## *Power Module*

**$V_{DSS}$ = 800V**
**$R_{DSon}$ = 150mΩ max @ Tj = 25°C**
**$I_D$ = 28A @ Tc = 25°C**




Pins 3/4 must be shorted together

**Application**

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies
- Motor control

**Features**

- COOLMOS Power Semiconductors
  - Ultra low $R_{DSon}$
  - Low Miller capacitance
  - Ultra low gate charge
  - Avalanche energy rated
  - Very rugged
- Very low stray inductance
  - Symmetrical design
- Internal thermistor for temperature monitoring
- High level of integration

**Benefits**

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- Each leg can be easily paralleled to achieve a phase leg of twice the current capability
- RoHS Compliant

## Absolute maximum ratings

| *Symbol* | *Parameter* | | *Max ratings* | *Unit* |
|---|---|---|---|---|
| $V_{DSS}$ | Drain - Source Breakdown Voltage | | 800 | V |
| $I_D$ | Continuous Drain Current | $T_c$ = 25°C | 28 | A |
| | | $T_c$ = 80°C | 21 | |
| $I_{DM}$ | Pulsed Drain current | | 110 | |
| $V_{GS}$ | Gate - Source Voltage | | ±30 | V |
| $R_{DSon}$ | Drain - Source ON Resistance | | 150 | mΩ |
| $P_D$ | Maximum Power Dissipation | $T_c$ = 25°C | 277 | W |
| $I_{AR}$ | Avalanche current (repetitive and non repetitive) | | 17 | A |
| $E_{AR}$ | Repetitive Avalanche Energy | | 0.5 | mJ |
| $E_{AS}$ | Single Pulse Avalanche Energy | | 670 | |

**CAUTION:** These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

**All ratings @ $T_j$ = 25°C unless otherwise specified**

## Electrical Characteristics

| Symbol | Characteristic | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{GS}$ = 0V,$V_{DS}$ = 800V | $T_j$ = 25°C | | | 50 | µA |
| | | $V_{GS}$ = 0V,$V_{DS}$ = 800V | $T_j$ = 125°C | | | 375 | |
| $R_{DS(on)}$ | Drain – Source on Resistance | $V_{GS}$ = 10V, $I_D$ = 14A | | | | 150 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 2mA | | 2.1 | 3 | 3.9 | V |
| $I_{GSS}$ | Gate – Source Leakage Current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0V | | | | ±150 | nA |

## Dynamic Characteristics

| Symbol | Characteristic | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{GS}$ = 0V<br>$V_{DS}$ = 25V<br>f = 1MHz | | 4507 | | pF |
| $C_{oss}$ | Output Capacitance | | | 2092 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 108 | | |
| $Q_g$ | Total gate Charge | $V_{GS}$ = 10V<br>$V_{Bus}$ = 400V<br>$I_D$ = 28A | | 180 | | nC |
| $Q_{gs}$ | Gate – Source Charge | | | 22 | | |
| $Q_{gd}$ | Gate – Drain Charge | | | 90 | | |
| $T_{d(on)}$ | Turn-on Delay Time | **Inductive switching @125°C**<br>$V_{GS}$ = 15V<br>$V_{Bus}$ = 533V<br>$I_D$ = 28A<br>$R_G$ = 2.5Ω | | 10 | | ns |
| $T_r$ | Rise Time | | | 13 | | |
| $T_{d(off)}$ | Turn-off Delay Time | | | 83 | | |
| $T_f$ | Fall Time | | | 35 | | |
| $E_{on}$ | Turn-on Switching Energy | **Inductive switching @ 25°C**<br>$V_{GS}$ = 15V, $V_{Bus}$ = 533V<br>$I_D$ = 28A, $R_G$ = 2.5Ω | | 486 | | µJ |
| $E_{off}$ | Turn-off Switching Energy | | | 278 | | |
| $E_{on}$ | Turn-on Switching Energy | **Inductive switching @ 125°C**<br>$V_{GS}$ = 15V, $V_{Bus}$ = 533V<br>$I_D$ = 28A, $R_G$ = 2.5Ω | | 850 | | µJ |
| $E_{off}$ | Turn-off Switching Energy | | | 342 | | |

## Source - Drain diode ratings and characteristics

| Symbol | Characteristic | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source current (Body diode) | | Tc = 25°C | | 28 | | A |
| | | | Tc = 80°C | | 21 | | |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = - 28A | | | | 1.2 | V |
| dv/dt | Peak Diode Recovery ❶ | | | | | 6 | V/ns |
| $t_{rr}$ | Reverse Recovery Time | $I_S$ = - 28A<br>$V_R$ = 400V<br>$di_S/dt$ = 200A/µs | $T_j$ = 25°C | | 550 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | $T_j$ = 25°C | | 30 | | µC |

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \leq$ - 28A  di/dt ≤ 200A/µs  $V_R \leq V_{DSS}$  $T_j \leq$ 150°C

## Thermal and package characteristics

| Symbol | Characteristic | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction to Case Thermal Resistance | | | | | 0.45 | °C/W |
| $V_{ISOL}$ | RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz | | | 4000 | | | V |
| $T_J$ | Operating junction temperature range | | | -40 | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | | -40 | | 125 | °C |
| $T_C$ | Operating Case Temperature | | | -40 | | 100 | °C |
| Torque | Mounting torque | To heatsink | M4 | 2 | | 3 | N.m |
| Wt | Package Weight | | | | | 80 | g |

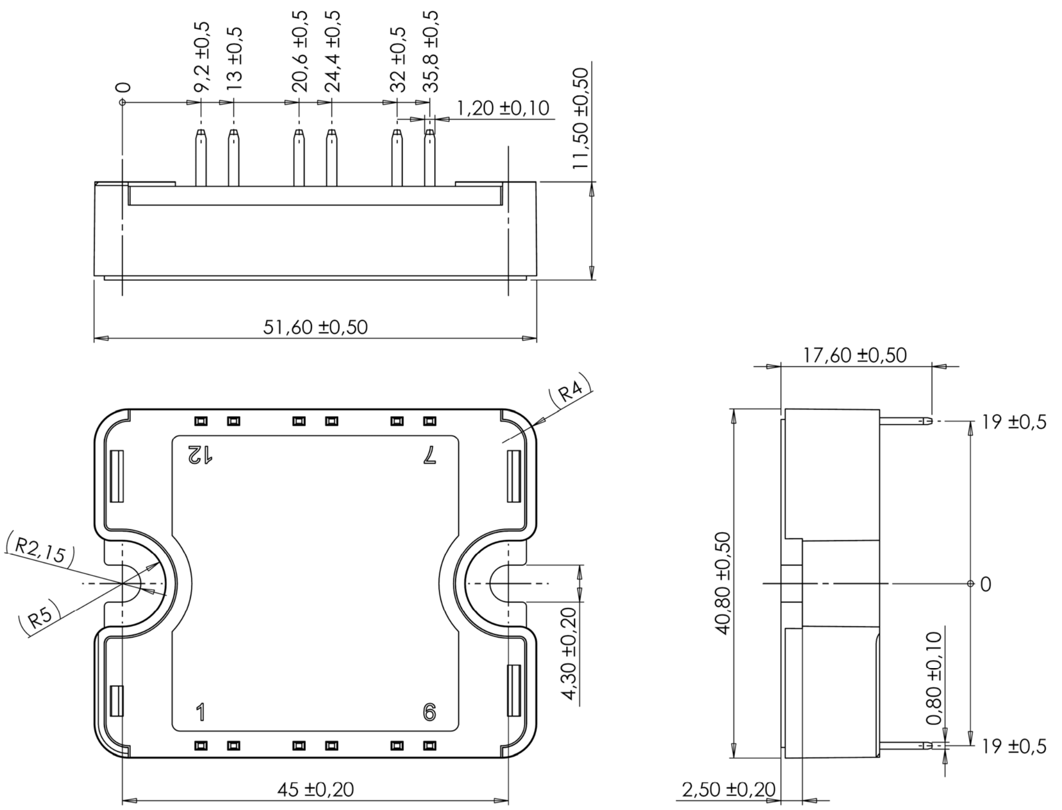
## Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

| Symbol | Characteristic | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $R_{25}$ | Resistance @ 25°C | | 50 | | kΩ |
| $B_{25/85}$ | $T_{25} = 298.15$ K | | 3952 | | K |

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

T: Thermistor temperature
$R_T$: Thermistor value at T

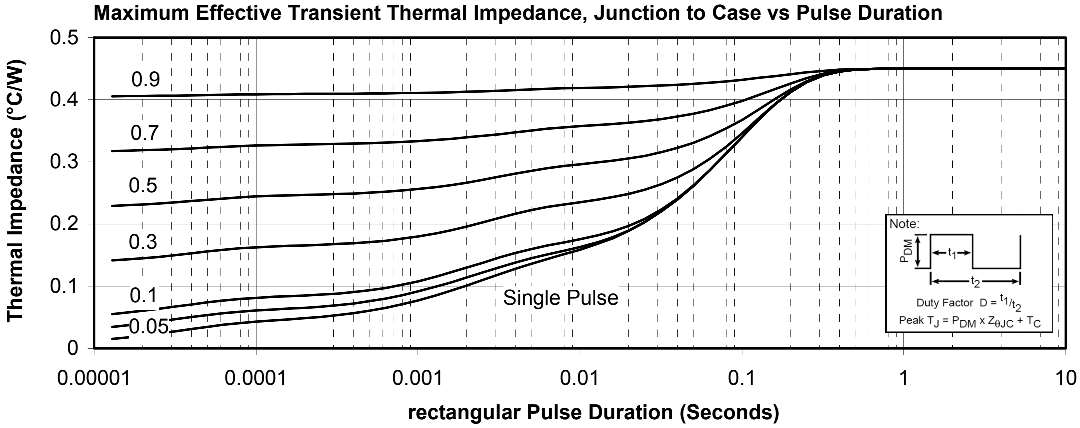
## SP1 Package outline (dimensions in mm)



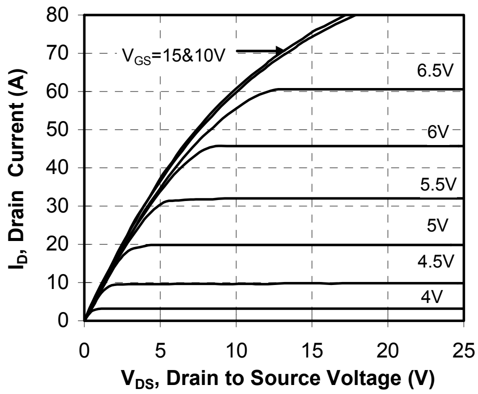

See application note 1904 - Mounting Instructions for SP1 Power Modules on www.microsemi.com

## Typical Performance Curve

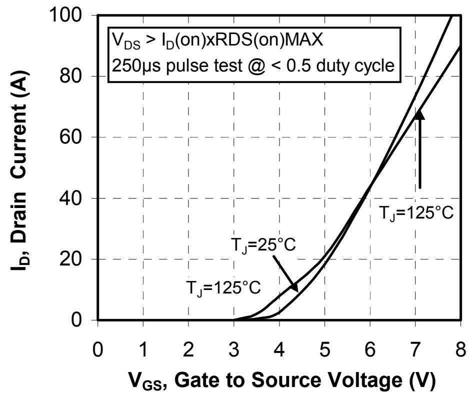
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



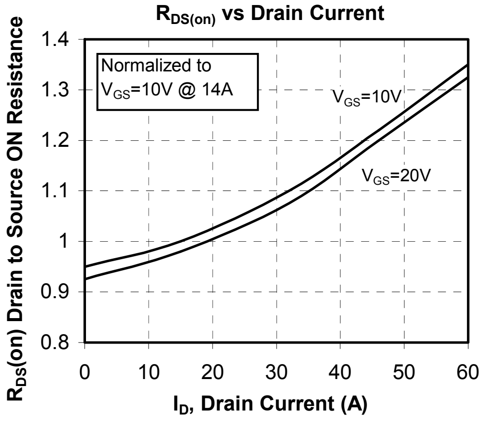

Low Voltage Output Characteristics



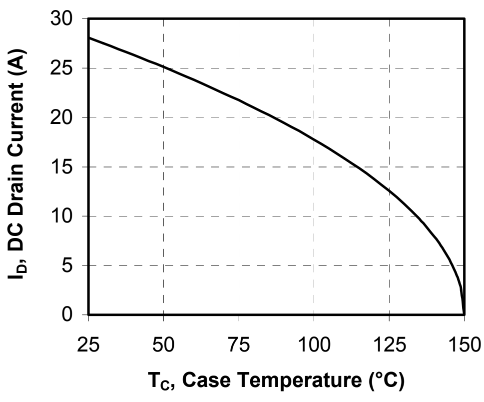

Transfert Characteristics

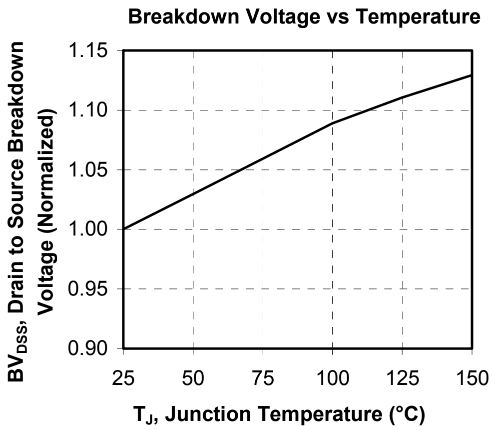


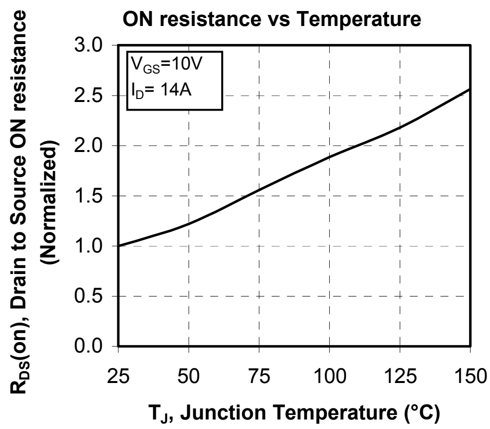

$R_{DS(on)}$ vs Drain Current

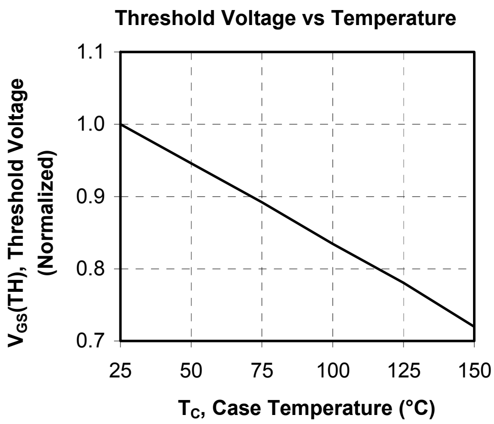


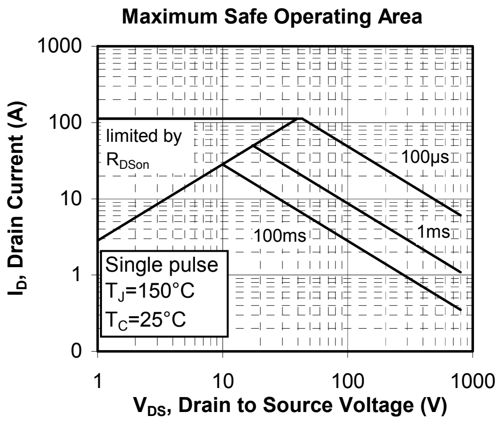

DC Drain Current vs Case Temperature

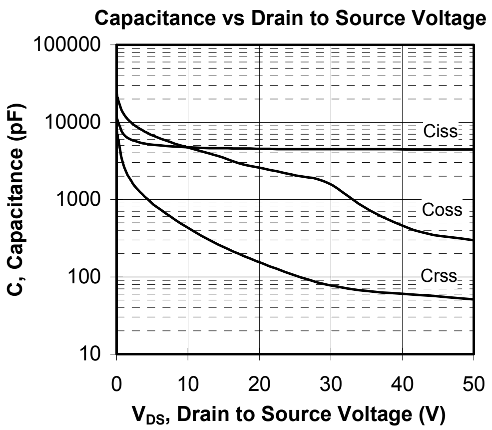


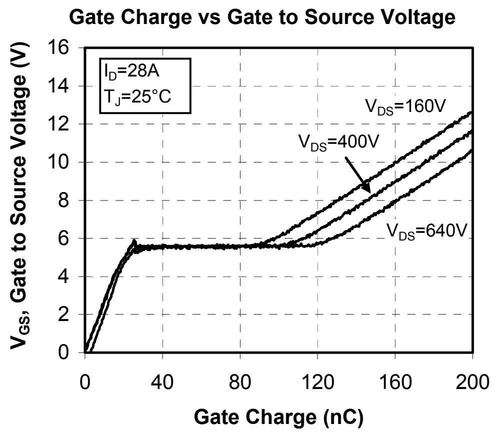

Breakdown Voltage vs Temperature
BV_DSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
0.90
25 50 75 100 125 150
T_J, Junction Temperature (°C)


ON resistance vs Temperature
R_DS(on), Drain to Source ON resistance (Normalized)
V_GS=10V
I_D= 14A
3.0
2.5
2.0
1.5
1.0
0.5
0.0
25 50 75 100 125 150
T_J, Junction Temperature (°C)

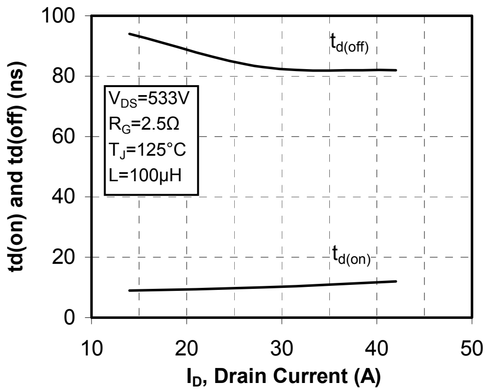

Threshold Voltage vs Temperature
V_GS(TH), Threshold Voltage (Normalized)
1.1
1.0
0.9
0.8
0.7
25 50 75 100 125 150
T_C, Case Temperature (°C)


Maximum Safe Operating Area
I_D, Drain Current (A)
1000
100
10
1
0
limited by R_DSon
100µs
1ms
100ms
Single pulse
T_J=150°C
T_C=25°C
1 10 100 1000
V_DS, Drain to Source Voltage (V)

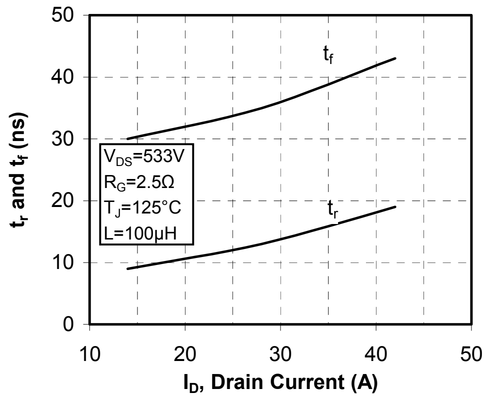

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
10
Ciss
Coss
Crss
0 10 20 30 40 50
V_DS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
V_GS, Gate to Source Voltage (V)
16
14
12
10
8
6
4
2
0
I_D=28A
T_J=25°C
V_DS=160V
V_DS=400V
V_DS=640V
0 40 80 120 160 200
Gate Charge (nC)

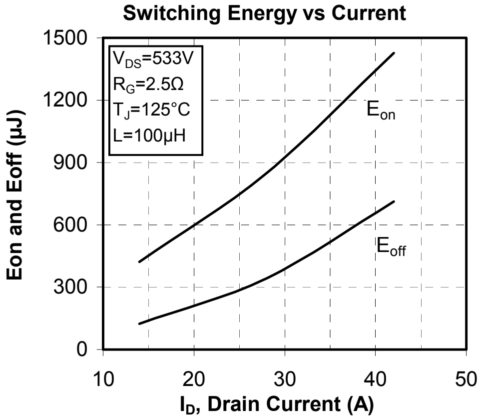
Delay Times vs Current



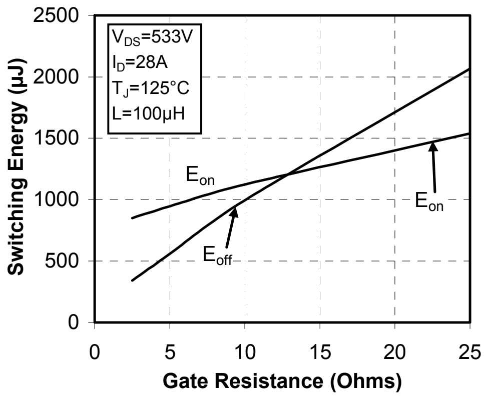

Rise and Fall times vs Current



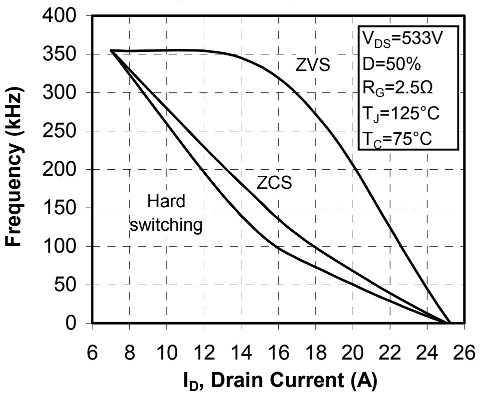

Switching Energy vs Current



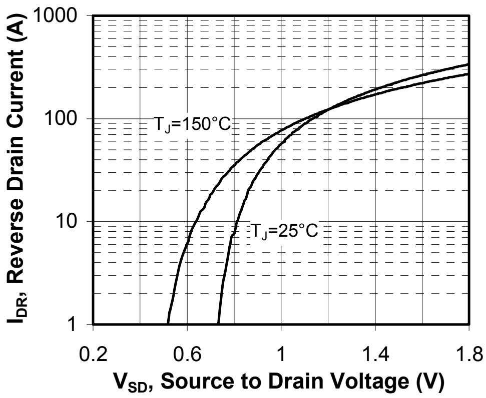

Switching Energy vs Gate Resistance




Operating Frequency vs Drain Current




Source to Drain Diode Forward Voltage

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