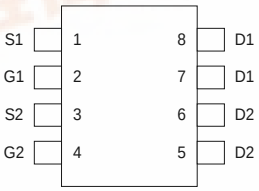
# APM4542

Dual Enhancement Mode MOSFET (N-and P-Channel)

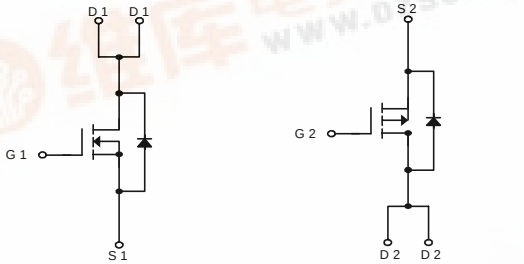
## Features

- N-Channel
  30V/7A, $R_{DS(ON)}$=17mΩ(typ.) @ $V_{GS}$=10V
  $R_{DS(ON)}$=22mΩ(typ.) @ $V_{GS}$=4.5V
- P-Channel
  -30V/-5.5A,$R_{DS(ON)}$=35mΩ(typ.) @ $V_{GS}$=-10V
  $R_{DS(ON)}$=51mΩ(typ.) @ $V_{GS}$=-4.5V
- Super High Dense Cell Design for Extremely Low $R_{DS(ON)}$
- Reliable and Rugged
- SO-8 Package

## Pin Description




SO-8




N-Channel MOSFET P-Channel MOSFET

## Applications

- Power Management in Notebook Computer , Portable Equipment and Battery Powered Systems.

## Ordering and Marking Information

| | |
|---|---|
| APM4542 □□-□□□<br>Lead Free Code<br>Handling Code<br>Temp. Range<br>Package Code | Package Code<br>K : SO-8<br>Operation Junction Temp. Range<br>C : -55 to 150°C<br>Handling Code<br>TR : Tape & Reel<br>Lead Free Code<br>L : Lead Free Device Blank : Orginal Device |
| APM4542 K : APM4542 XXXXX | XXXXX - Date Code |

## Absolute Maximum Ratings (T$_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | | N-Channel | P-Channel | Unit |
|---|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | 30 | -30 | V |
| $V_{GSS}$ | Gate-Source Voltage | | ±20 | ±20 | |
| $I_D$* | Maximum Drain Current – Continuous | | 7 | -5 | A |
| $I_{DM}$ | Maximum Drain Current – Pulsed | | 28 | -20 | |
| $P_D$ | Maximum Power Dissipation | $T_A$=25°C | 2 | 2 | W |
| | | $T_A$=100°C | 0.8 | 0.8 | |
| $T_J$ | Maximum Junction Temperature | | 150 | | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | | °C |
| $R_{\theta jA}$ | Thermal Resistance – Junction to Ambient | | 62.5 | | °C/W |

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

## Electrical Characteristics (T$_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Condition | | APM4542 Min. | APM4542 Typ. | APM4542 Max. | Unit |
|---|---|---|---|---|---|---|---|
| **Static** | | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_{DS}$=250µA | N-Ch | 30 | | | V |
| | | | P-Ch | -30 | | | |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=24V , $V_{GS}$=0V | N-Ch | | | 1 | µA |
| | | $V_{DS}$=-24V , $V_{GS}$=0V | P-Ch | | | -1 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ , $I_{DS}$=250µA | N-Ch | 1 | 1.5 | 2 | V |
| | | $V_{DS}$=$V_{GS}$ , $I_{DS}$=-250µA | P-Ch | -1 | -1.5 | -2 | |
| $I_{GSS}$ | Gate Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | N-Ch | | | ±100 | nA |
| | | $V_{GS}$=±20V , $V_{DS}$=0V | P-Ch | | | ±100 | |
| $R_{DS(ON)}$[a] | Drain-Source On-state Resistance | $V_{GS}$=10V , $I_{DS}$=7A | N-Ch | | 17 | 24 | mΩ |
| | | $V_{GS}$=4.5V , $I_{DS}$=5A | | | 22 | 30 | |
| | | $V_{GS}$=-10V , $I_{DS}$=-5.5A | P-Ch | | 35 | 56 | |
| | | $V_{GS}$=-4.5V , $I_{DS}$=-4A | | | 51 | 78 | |
| $V_{SD}$[a] | Diode Forward Voltage | $I_{SD}$=2A , $V_{GS}$=0V | N-Ch | | 0.7 | 1.3 | V |
| | | $I_{SD}$=-2.3A , $V_{GS}$=0V | P-Ch | | -0.7 | -1.3 | |

Notes

[a] : Pulse test ; pulse width ≤300µs, duty cycle ≤ 2%

## Electrical Characteristics (Cont.) ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Test Condition | | APM4542 Min. | APM4542 Typ. | APM4542 Max. | Unit |
|---|---|---|---|---|---|---|---|
| **Dynamic[b]** | | | | | | | |
| $Q_g$ | Total Gate Charge | N-Channel | N-Ch | | 19 | 28 | nC |
| | | $V_{DS}$=15V , $I_{DS}$= 7A | P-Ch | | 28 | 36 | |
| $Q_{gs}$ | Gate-Source Charge | $V_{GS}$=10V | N-Ch | | 1.6 | | |
| | | P-Channel | P-Ch | | 5 | | |
| $Q_{gd}$ | Gate-Drain Charge | $V_{DS}$=-15V , $I_{DS}$=-5.5A | N-Ch | | 3.6 | | |
| | | $V_{GS}$=-10V | P-Ch | | 4 | | |
| $t_{d(ON)}$ | Turn-on Delay Time | N-Channel | N-Ch | | 11 | 20 | ns |
| | | $V_{DD}$=15V , $I_{DS}$=2A , | P-Ch | | 12 | 24 | |
| $T_r$ | Turn-on Rise Time | $V_{GEN}$=10V , $R_G$=6Ω , | N-Ch | | 17 | 28 | |
| | | $R_L$=7.5Ω | P-Ch | | 15 | 29 | |
| $t_{d(OFF)}$ | Turn-off Delay Time | P-Channel | N-Ch | | 36 | 62 | |
| | | $V_{DD}$=-15V , $I_{DS}$=-2A , | P-Ch | | 35 | 60 | |
| $T_f$ | Turn-off Fall Time | $V_{GEN}$=-10V , $R_G$=6Ω , | N-Ch | | 20 | 36 | |
| | | $R_L$=7.5Ω | P-Ch | | 15 | 30 | |
| $C_{iss}$ | Input Capacitance | N-Channel | N-Ch | | 835 | | pF |
| | | $V_{GS}$=0V, $V_{DS}$=25V | P-Ch | | 950 | | |
| $C_{oss}$ | Output Capacitance | Frequency=1.0MHz | N-Ch | | 145 | | |
| | | P-Channel | P-Ch | | 160 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | $V_{GS}$=0V, $V_{DS}$=-25V | N-Ch | | 15 | | |
| | | Frequency=1.0MHz | P-Ch | | 110 | | |

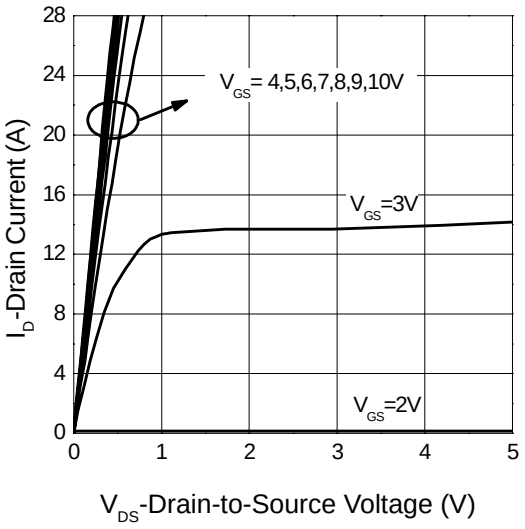
Notes

[b] : Guaranteed by design, not subject to production testing

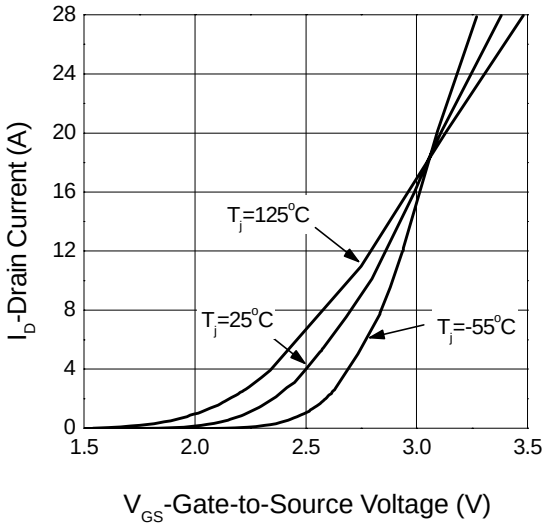
## Typical Characteristics

N-Channel

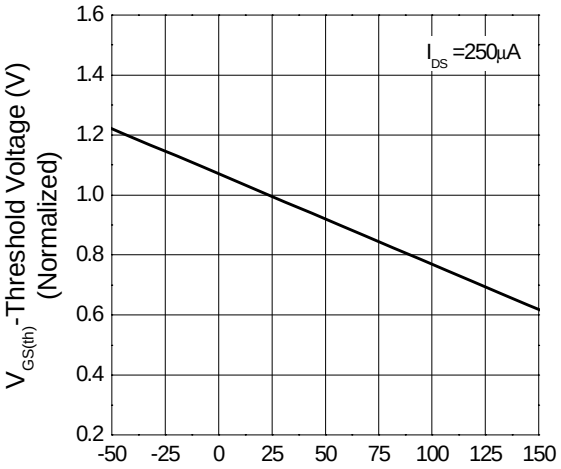
Output Characteristics



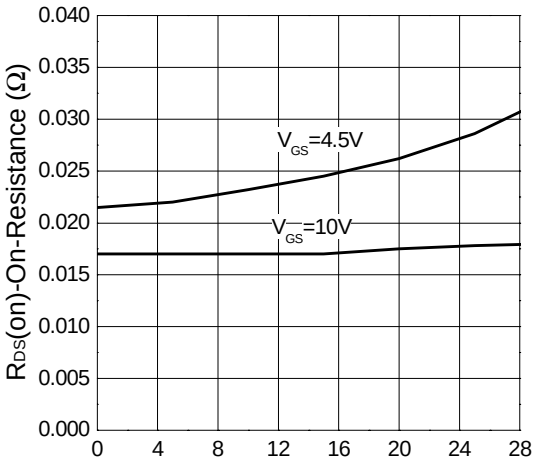

Transfer Characteristics




Threshold Voltage vs. Junction Temperature



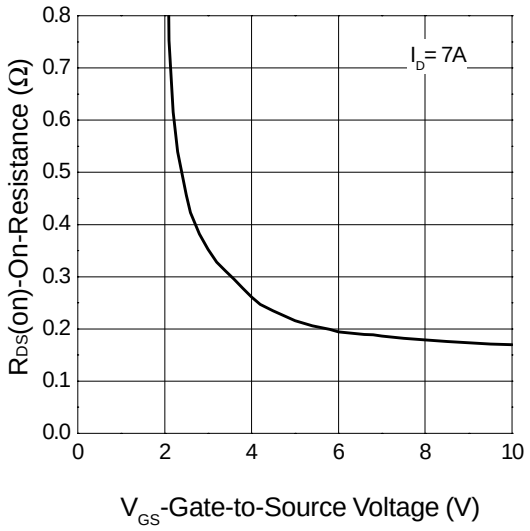

On-Resistance vs. Drain Current



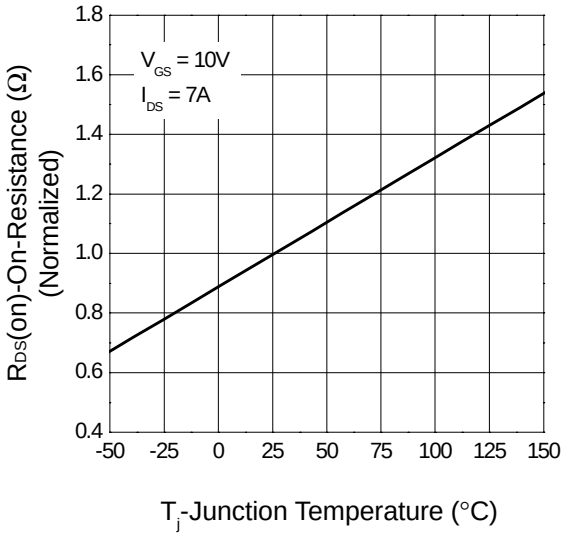
## Typical Characteristics (Cont.)

N-Channel

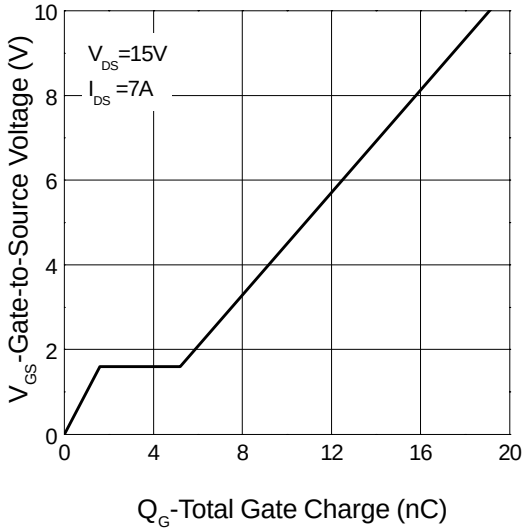
On-Resistance vs. Gate-to-Source Voltage



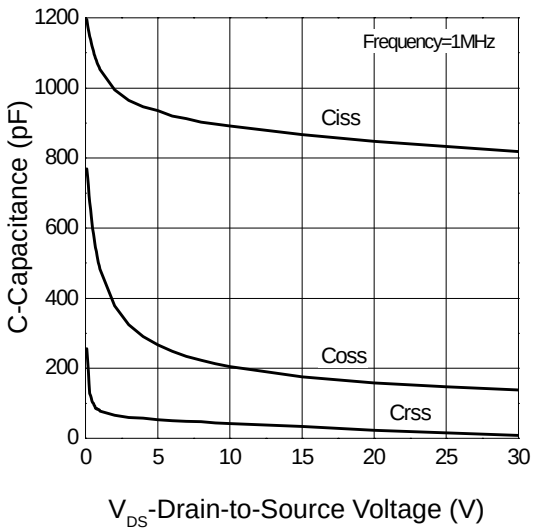

On-Resistaence vs. Junction Temperature




Gate Charge



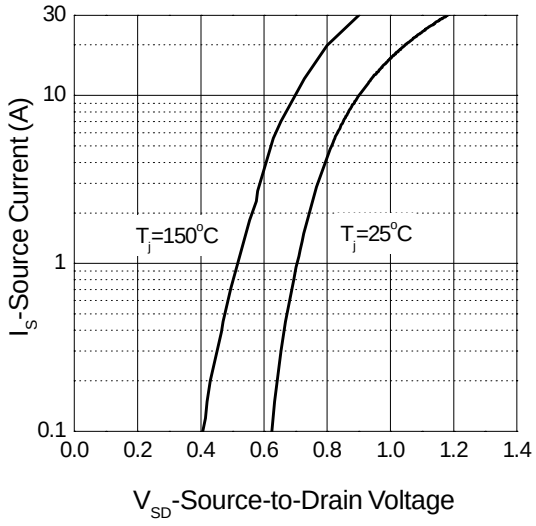

Capacitance Characteristics



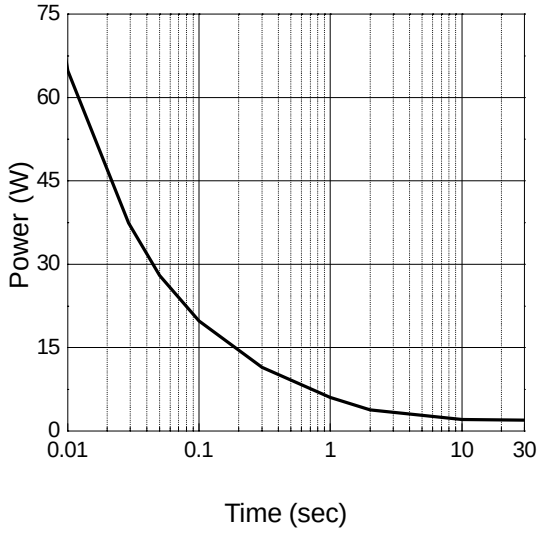
## Typical Characteristics (Cont.)

N-Channel

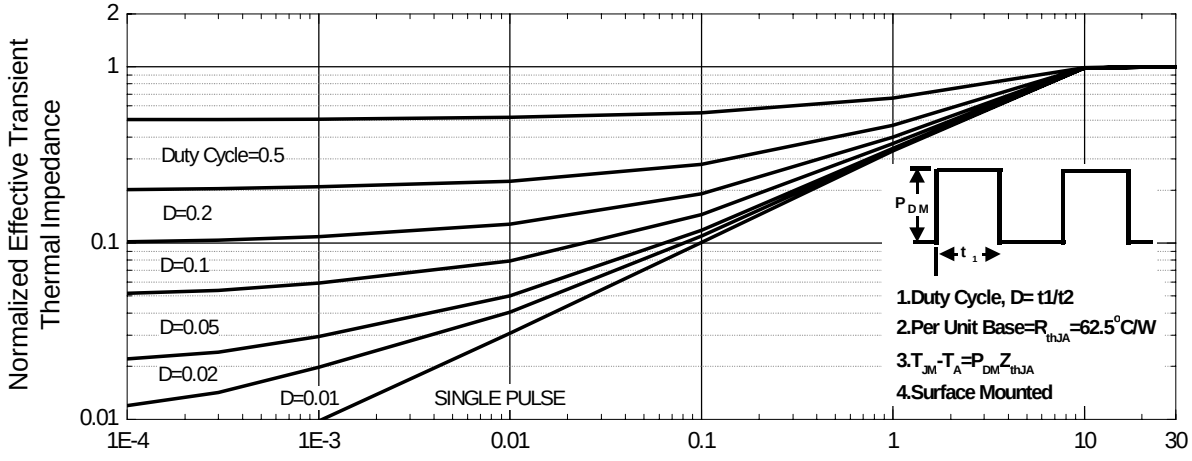
Source-Drain Diode Forward Voltage




Single Pulse Power



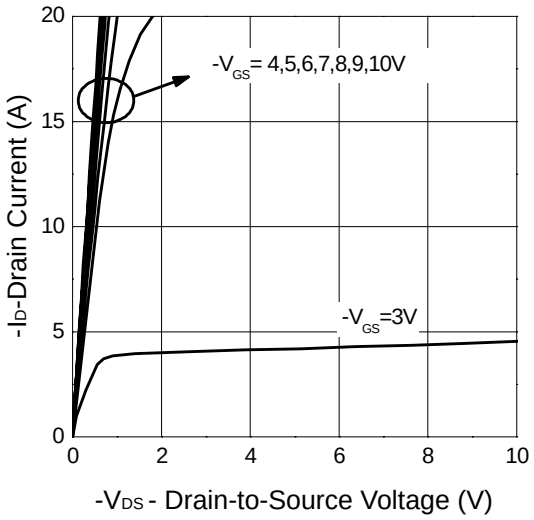

Normalized Transient Thermal Transient Impedence, Junction to Ambient



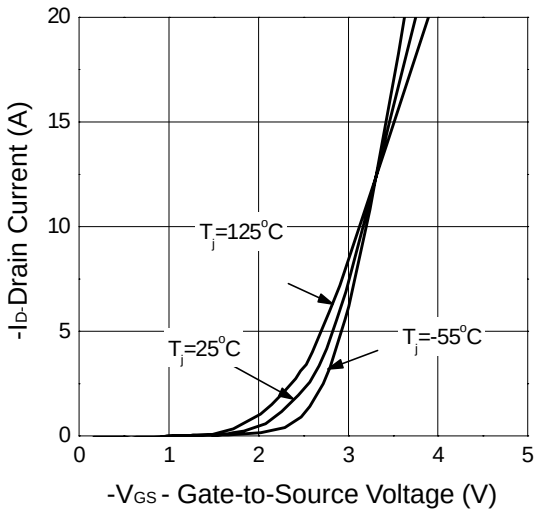
## Typical Characteristics

P-Channel

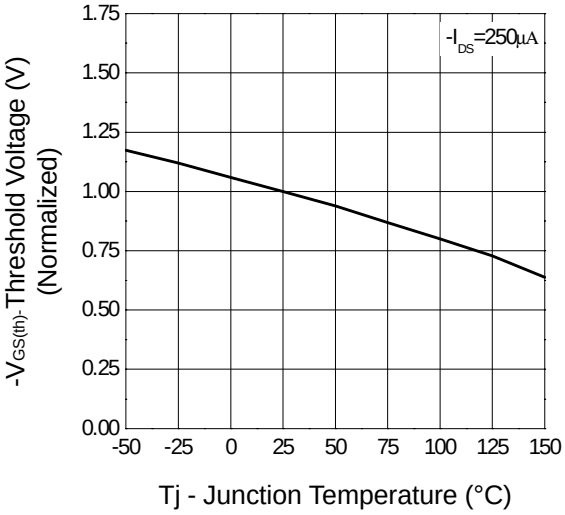
Output Characteristics



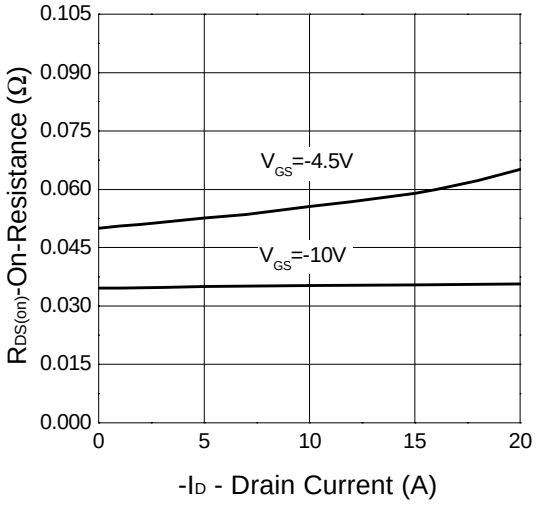

Transfer Characteristics




Threshold Voltage vs. Junction Temperature



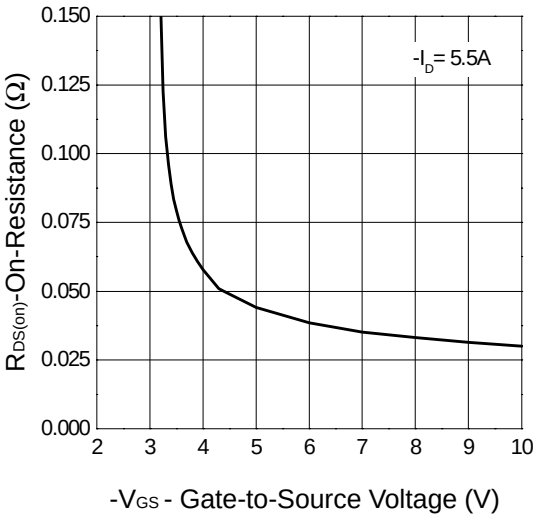

On-Resistance vs. Drain Current



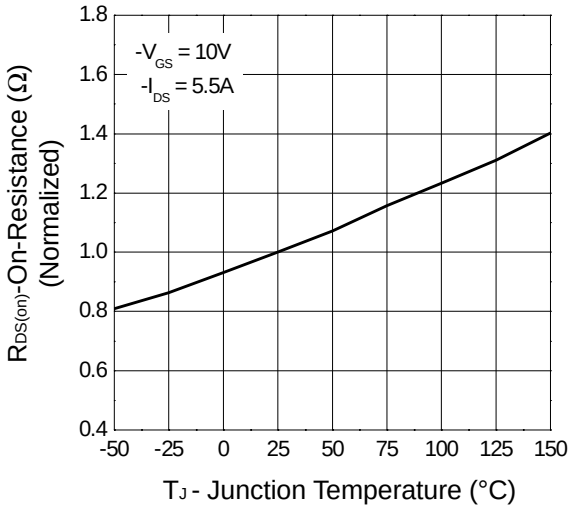
## Typical Characteristics (Cont.)

P-Channel

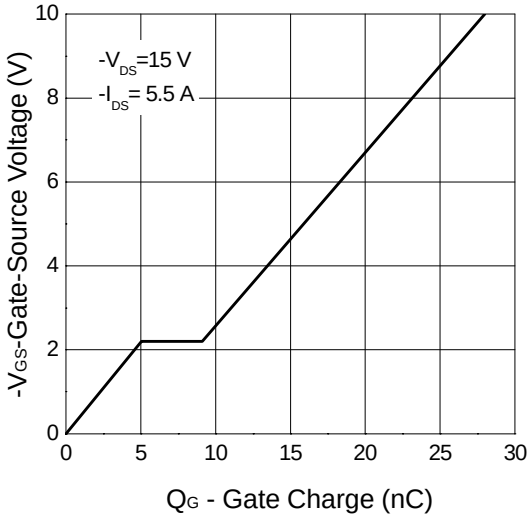
On-Resistance vs. Gate-to-Source Voltage



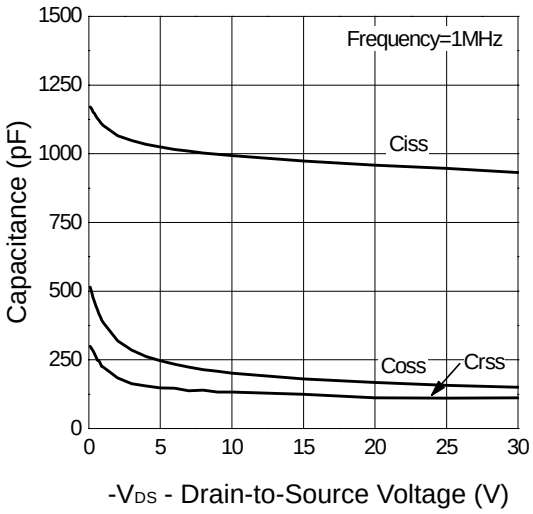

On-Resistance vs. Junction Temperature




Gate Charge



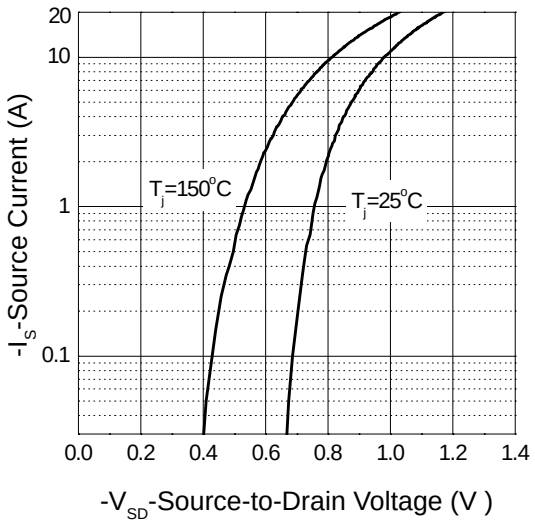

Capacitance



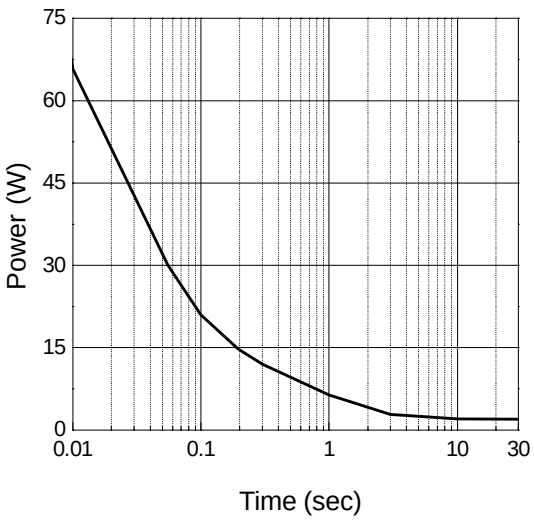
## Typical Characteristics (Cont.)

P-Channel

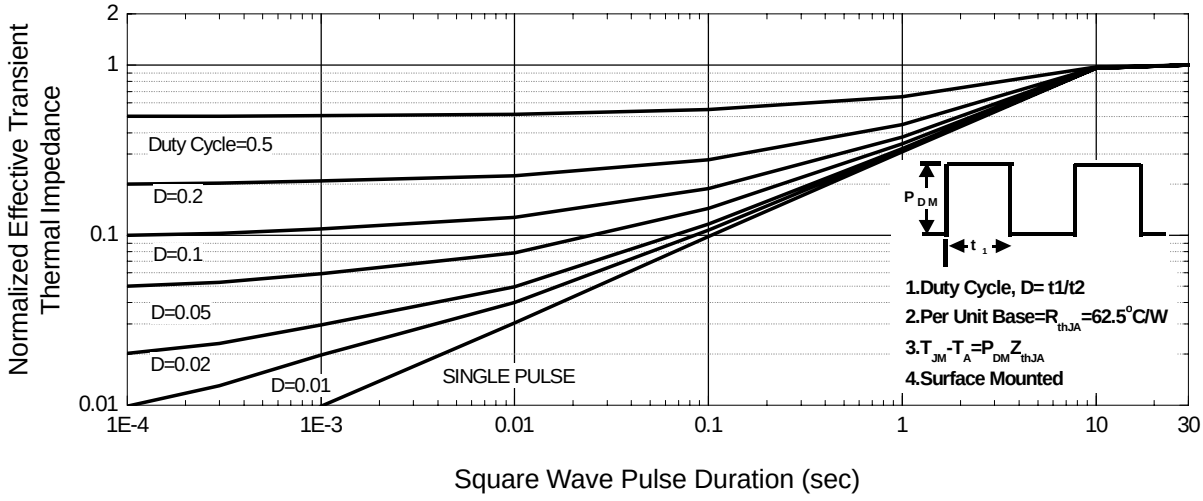
Source-Drain Diode Forward Voltage




Single Pulse Power

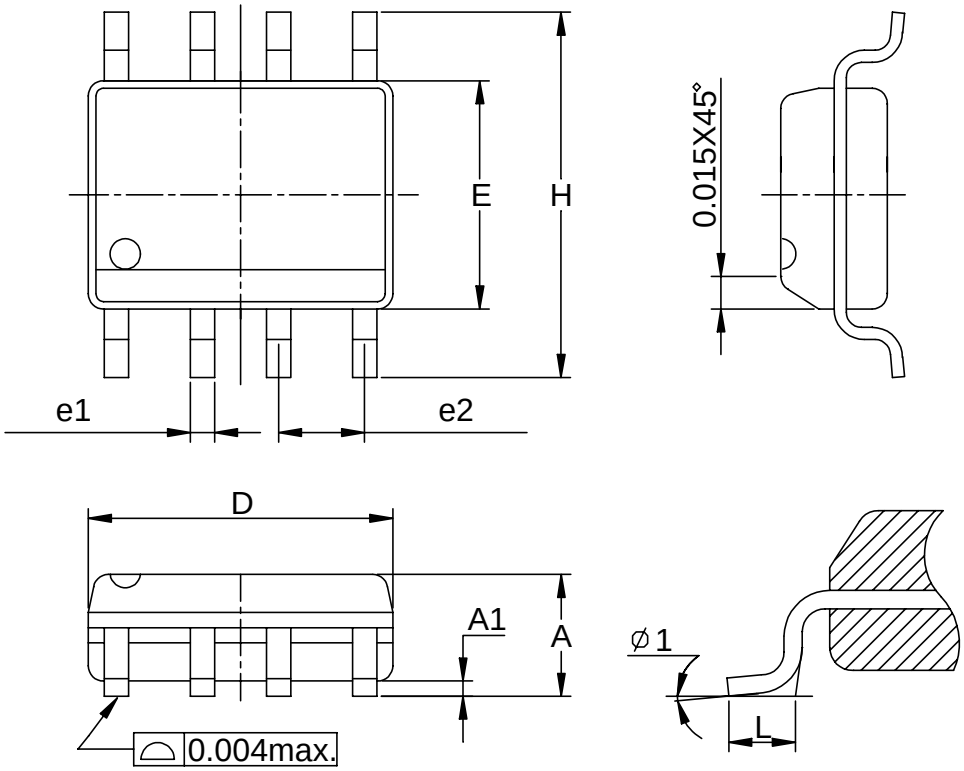



Normalized Thermal Transient Impedance, Junction to Ambient



## Packaging Information

SOP-8 pin ( Reference JEDEC Registration MS-012)



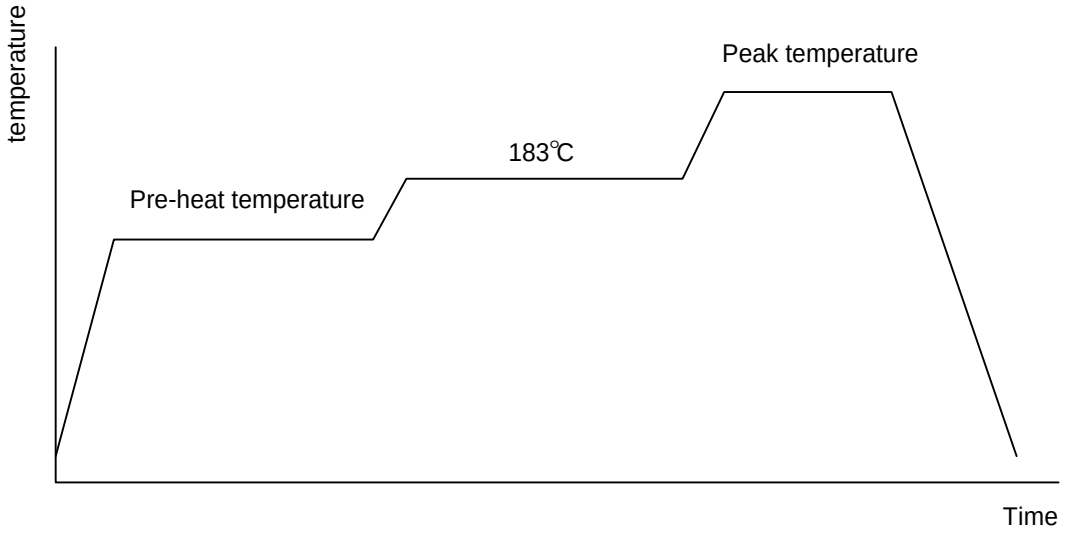

| Dim | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| D | 4.80 | 5.00 | 0.189 | 0.197 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| L | 0.40 | 1.27 | 0.016 | 0.050 |
| e1 | 0.33 | 0.51 | 0.013 | 0.020 |
| e2 | 1.27BSC | | 0.50BSC | |
| ϕ 1 | 8° | | 8° | |

## Physical Specifications

| | |
|---|---|
| Terminal Material | Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb) |
| Lead Solderability | Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3. |

## Reflow Condition (IR/Convection or VPR Reflow)

Reference JEDEC Standard J-STD-020A APRIL 1999




## Classification Reflow Profiles

| | Convection or IR/ Convection | VPR |
|---|---|---|
| Average ramp-up rate(183°C to Peak) | 3°C/second max. | 10 °C /second max. |
| Preheat temperature 125 ± 25°C) | 120 seconds max | |
| Temperature maintained above 183°C | 60 – 150 seconds | |
| Time within 5°C of actual peak temperature | 10 –20 seconds | 60 seconds |
| Peak temperature range | 220 +5/-0°C or 235 +5/-0°C | 215-219°C or 235 +5/-0°C |
| Ramp-down rate | 6 °C /second max. | 10 °C /second max. |
| Time 25°C to peak temperature | 6 minutes max. | |

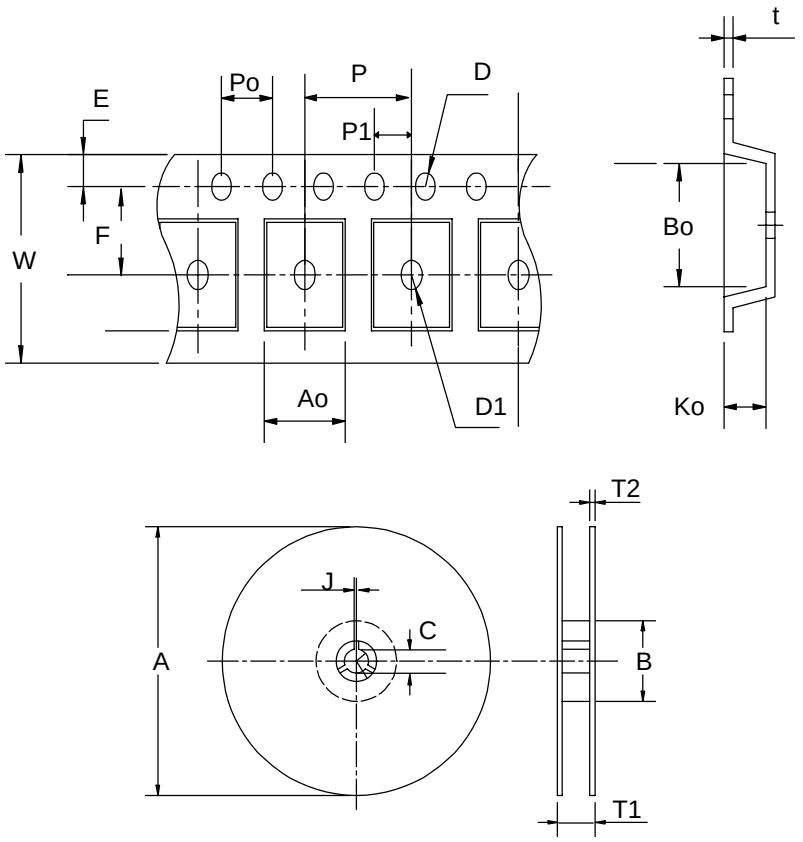
## Package Reflow Conditions

| **pkg. thickness ≥ 2.5mm and all bgas** | **pkg. thickness < 2.5mm and pkg. volume ≥ 350 mm³** | **pkg. thickness < 2.5mm and pkg. volume < 350mm³** |
|---|---|---|
| Convection 220 +5/-0 °C | | Convection 235 +5/-0 °C |
| VPR 215-219 °C | | VPR 235 +5/-0 °C |
| IR/Convection 220 +5/-0 °C | | IR/Convection 235 +5/-0 °C |

## Reliability test program

| Test item | Method | Description |
|---|---|---|
| SOLDERABILITY | MIL-STD-883D-2003 | 245°C,5 SEC |
| HOLT | MIL-STD 883D-1005.7 | 1000 Hrs Bias @ 125°C |
| PCT | JESD-22-B, A102 | 168 Hrs, 100% RH, 121°C |
| TST | MIL-STD 883D-1011.9 | -65°C ~ 150°C, 200 Cycles |

## Carrier Tape & Reel Dimensions




| Application | A | B | C | J | T1 | T2 | W | P | E |
|---|---|---|---|---|---|---|---|---|---|
| SOP- 8 | 330 ± 1 | 62 +1.5 | 12.75+ 0.15 | 2 ± 0.5 | 12.4 ± 0.2 | 2 ± 0.2 | 12± 0. 3 | 8± 0.1 | 1.75±0.1 |
| | F | D | D1 | Po | P1 | Ao | Bo | Ko | t |
| | 5.5± 1 | 1.55 +0.1 | 1.55+ 0.25 | 4.0 ± 0.1 | 2.0 ± 0.1 | 6.4 ± 0.1 | 5.2± 0. 1 | 2.1± 0.1 | 0.3±0.013 |

## Cover Tape Dimensions

| Application | Carrier Width | Cover Tape Width | Devices Per Reel |
|---|---|---|---|
| **SOP- 8** | 12 | 9.3 | 2500 |

## Customer Service

**Anpec Electronics Corp.**
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