



**N-channel Enhancement-mode Power MOSFET**

- Simple Drive Requirement**
- Good Thermal Performance**
- Low On-resistance**
- RoHS-compliant, halogen-free**

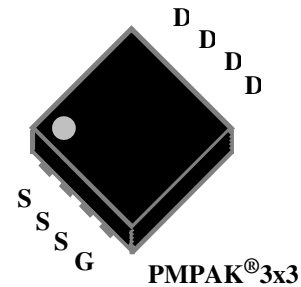


$BV_{DSS}$	30V
$R_{DS(ON)}$	18mΩ
$I_D$	11.5A

**Description**

Advanced Power MOSFETs from APEC provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The PMPAK<sup>®</sup>3x3 package is specially designed for DC-DC converter applications, with a small foot print that offers a backside heat sink and a low package profile.



**Absolute Maximum Ratings**

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	30	V
$V_{GS}$	Gate-Source Voltage	±20	V
$I_D$ at $T_A=25\text{ }^\circ\text{C}$	Continuous Drain Current <sup>3</sup>	11.5	A
$I_D$ at $T_A=70\text{ }^\circ\text{C}$	Continuous Drain Current <sup>3</sup>	9.4	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	40	A
$P_D$ at $T_A=25\text{ }^\circ\text{C}$	Total Power Dissipation	3.57	W
$T_{STG}$	Storage Temperature Range	-55 to 150	°C
$T_J$	Operating Junction Temperature Range	-55 to 150	°C

**Thermal Data**

Symbol	Parameter	Value	Units
Rthj-c	Maximum Thermal Resistance, Junction-case <sup>3</sup>	6	°C/W
Rthj-a	Maximum Thermal Resistance, Junction-ambient <sup>3</sup>	35	°C/W

**Ordering Information**

**AP9402GYT-HF-3TR**

**RoHS-compliant halogen-free PMPAK<sup>®</sup>3x3, shipped on tape and reel (3000pcs/reel)**

PMPAK<sup>®</sup> is a registered trademark of Advanced Power Electronics Corp.



**Electrical Specifications at  $T_j=25^\circ\text{C}$  (unless otherwise specified)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=10V, I_D=10A$	-	14	18	$m\Omega$
		$V_{GS}=4.5V, I_D=8A$	-	25	30	$m\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.5	3	V
$g_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=10A$	-	23	-	S
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=30V, V_{GS}=0V$	-	-	10	$\mu A$
$I_{GSS}$	Gate-Source Leakage	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
$Q_g$	Total Gate Charge <sup>2</sup>	$I_D=10A$	-	6.5	10.4	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=15V$	-	2	-	nC
$Q_{gd}$	Gate-Drain ("Miller") Charge	$V_{GS}=4.5V$	-	3.5	-	nC
$t_{d(on)}$	Turn-on Delay Time <sup>2</sup>	$V_{DS}=15V$	-	7	-	ns
$t_r$	Rise Time	$I_D=1A$	-	6	-	ns
$t_{d(off)}$	Turn-off Delay Time	$R_G=3.3\Omega, V_{GS}=10V$	-	17	-	ns
$t_f$	Fall Time		-	4	-	ns
$C_{iss}$	Input Capacitance	$V_{GS}=0V$	-	510	820	pF
$C_{oss}$	Output Capacitance	$V_{DS}=15V$	-	110	-	pF
$C_{rss}$	Reverse Transfer Capacitance	$f=1.0\text{MHz}$	-	90	-	pF
$R_g$	Gate Resistance	$f=1.0\text{MHz}$	-	1.4	2.2	$\Omega$

**Source-Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{SD}$	Forward On Voltage <sup>2</sup>	$I_S=2.9A, V_{GS}=0V$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time <sup>2</sup>	$I_S=10A, V_{GS}=0V,$	-	18	-	ns
$Q_{rr}$	Reverse Recovery Charge	$dI/dt=100A/\mu s$	-	9	-	nC

**Notes:**

1. Pulse width limited by maximum junction temperature
2. Pulse test
3. Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board,  $t \leq 10\text{sec}$ ,  $85^\circ\text{C}$  at steady state.

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

USE OF THIS PRODUCT AS A CRITICAL COMPONENT IN LIFE SUPPORT OR OTHER SIMILAR SYSTEMS IS NOT AUTHORIZED.

APEC DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

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Typical Electrical Characteristics

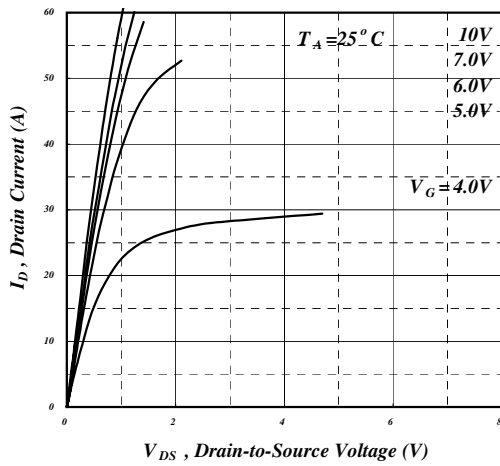


Fig 1. Typical Output Characteristics

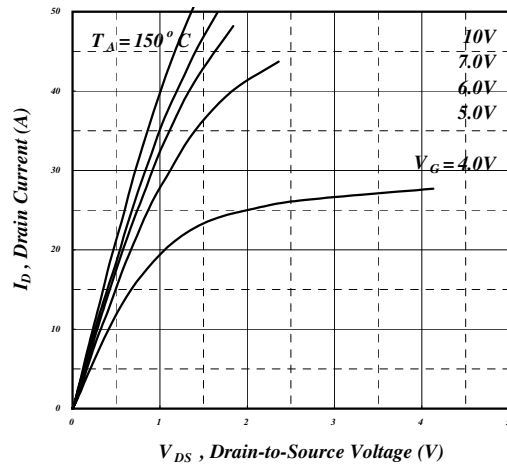


Fig 2. Typical Output Characteristics

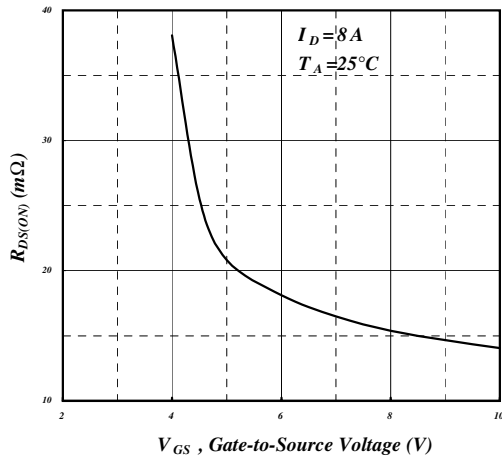


Fig 3. On-Resistance vs. Gate Voltage

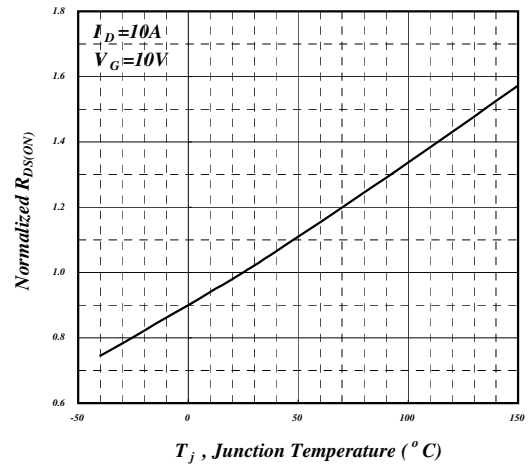


Fig 4. Normalized On-Resistance vs. Junction Temperature

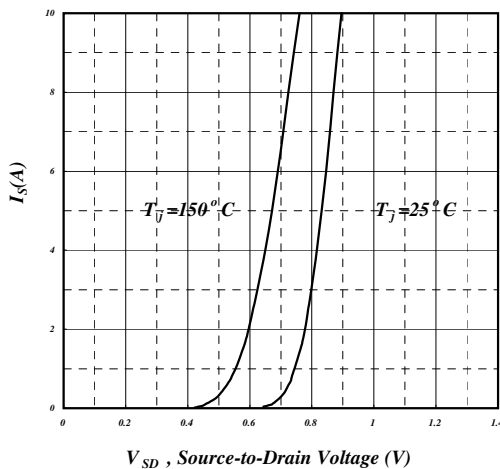


Fig 5. Forward Characteristic of Reverse Diode

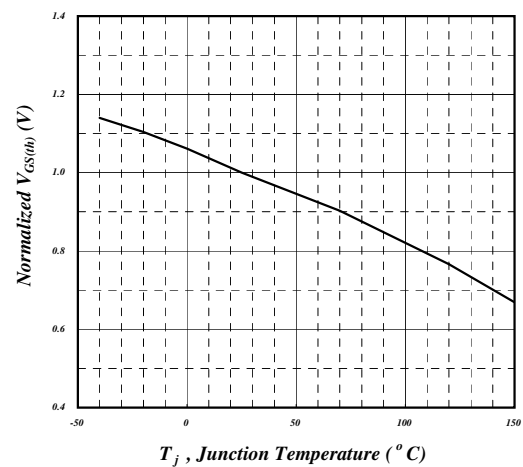


Fig 6. Gate Threshold Voltage vs. Junction Temperature



Typical Electrical Characteristics (cont.)

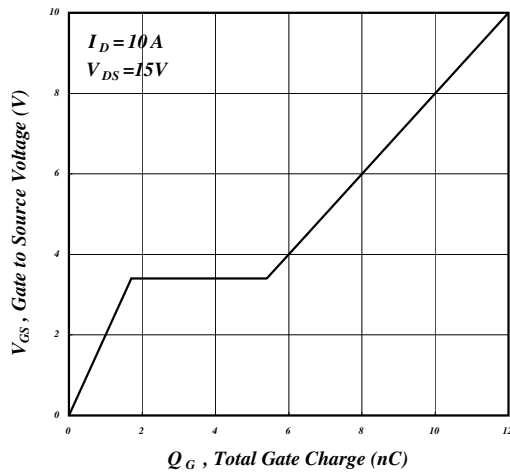


Fig 7. Gate Charge Characteristics

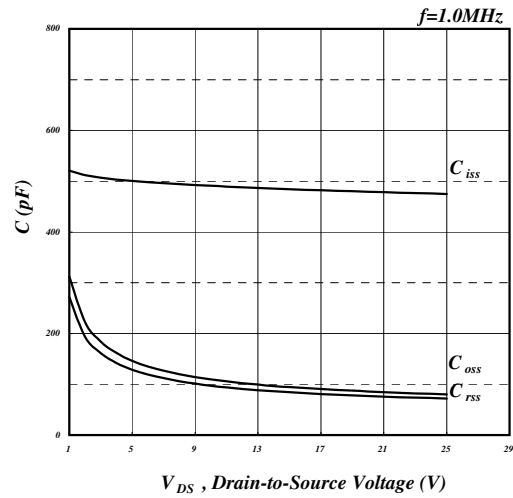


Fig 8. Typical Capacitance Characteristics

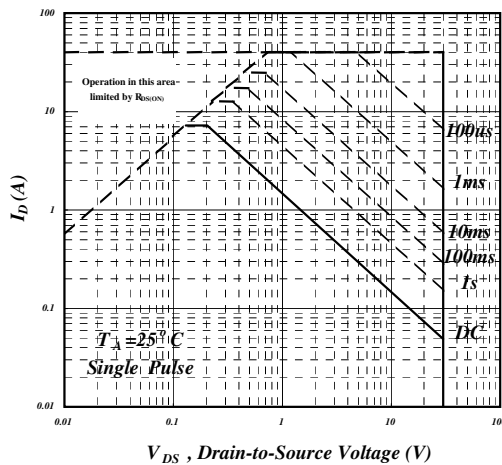


Fig 9. Maximum Safe Operating Area

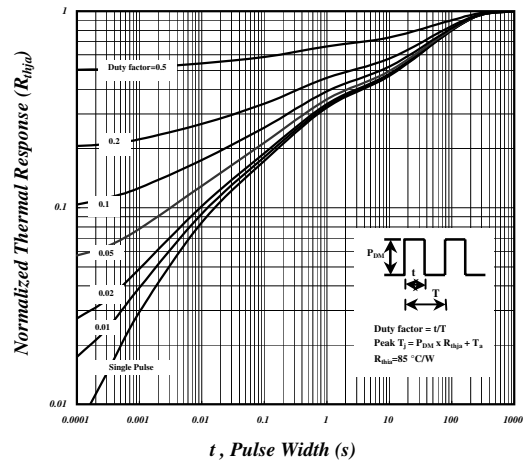


Fig 10. Effective Transient Thermal Impedance

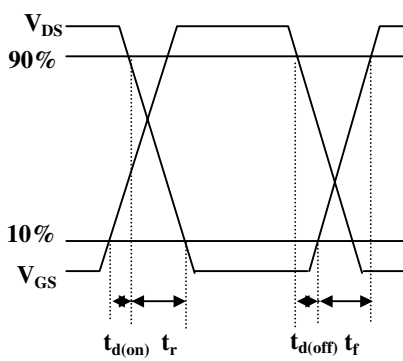


Fig 11. Switching Time Waveforms

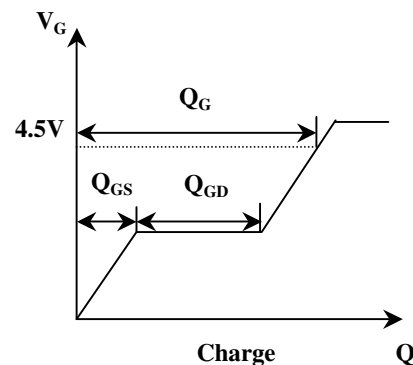
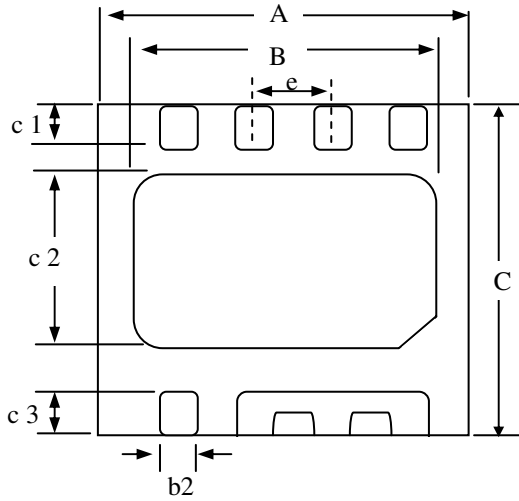


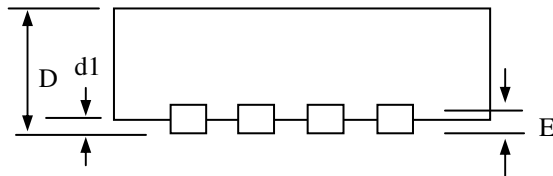
Fig 12. Gate Charge Waveform



**Package Dimensions: PMPAK<sup>®</sup>3x3**

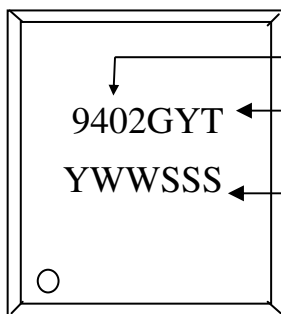


SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	2.95	3.00	3.05
B	2.35	2.40	2.45
e	0.65 (ref.)		
b2	0.30	0.35	0.40
C	2.95	3.00	3.05
c1	0.37	0.42	0.47
c2	1.65	1.70	1.75
c3	0.37	0.42	0.47
D	0.80	0.85	0.95
d1	0.00	-	0.05
E	0.178	0.203	0.228



1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

**Marking Information:**



- Product: AP9402
- Package code: 9402GYT  
GYT = RoHS-compliant halogen-free PMPAK<sup>®</sup>3x3
- Date Code (YWWSSS)  
Y: Last Digit Of The Year  
WW: Work week  
SSS: Lot code sequence