

# AP3990R-HF

Halogen-Free Product

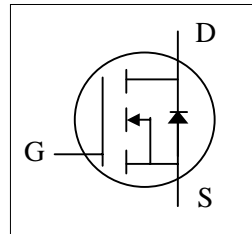


Advanced Power  
Electronics Corp.

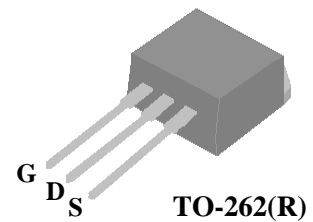
N-CHANNEL ENHANCEMENT MODE

POWER MOSFET

- ▼ 100% Avalanche Test
- ▼ Fast Switching Characteristic
- ▼ Simple Drive Requirement
- ▼ RoHS Compliant



$BV_{DSS}$	600V
$R_{DS(ON)}$	0.6 $\Omega$
$I_D$	10A



## Description

AP3990 series are specially designed as main switching devices for universal 90~265VAC off-line AC/DC converter applications. The TO-262 type provide high blocking voltage to overcome voltage surge and sag in the toughest power system with the best combination of fast switching, ruggedized design and cost-effectiveness.

The TO-262 package is widely preferred for commercial-industrial applications. The device is suited for switch mode power supplies, DC-AC converters and high current high speed switching circuits.

## Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
$V_{DS}$	Drain-Source Voltage	600	V
$V_{GS}$	Gate-Source Voltage	$\pm 30$	V
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V	10	A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS}$ @ 10V	6.5	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	40	A
$P_D@T_C=25^\circ C$	Total Power Dissipation	174	W
$E_{AS}$	Single Pulse Avalanche Energy <sup>2</sup>	50	mJ
$I_{AR}$	Avalanche Current	10	A
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	$^\circ C$

## Thermal Data

Symbol	Parameter	Value	Unit
Rthj-c	Maximum Thermal Resistance, Junction-case	0.72	$^\circ C/W$
Rthj-a	Maximum Thermal Resistance, Junction-ambient	62	$^\circ C/W$



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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=1.0mA$	600	-	-	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>3</sup>	$V_{GS}=10V, I_D=5.0A$	-	-	0.6	$\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2	-	4.5	V
$g_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=5A$	-	5	-	S
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=480V, V_{GS}=0V$	-	-	25	$\mu A$
	Drain-Source Leakage Current ( $T_j=150^{\circ}\text{C}$ )	$V_{DS}=480V, V_{GS}=0V$	-	-	250	$\mu A$
$I_{GSS}$	Gate-Source Leakage	$V_{GS}=\pm 30V$	-	-	$\pm 100$	nA
$Q_g$	Total Gate Charge <sup>3</sup>	$I_D=10A$	-	34	57	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=480V$	-	11	-	nC
$Q_{gd}$	Gate-Drain ("Miller") Charge	$V_{GS}=10V$	-	11	-	nC
$t_{d(on)}$	Turn-on Delay Time <sup>3</sup>	$V_{DD}=300V$	-	19	-	ns
$t_r$	Rise Time	$I_D=10A$	-	28	-	ns
$t_{d(off)}$	Turn-off Delay Time	$R_G=10\Omega, V_{GS}=10V$	-	43	-	ns
$t_f$	Fall Time	$R_D=30\Omega$	-	22	-	ns
$C_{iss}$	Input Capacitance	$V_{GS}=0V$	-	2030	3250	pF
$C_{oss}$	Output Capacitance	$V_{DS}=25V$	-	225	-	pF
$C_{rss}$	Reverse Transfer Capacitance	$f=1.0MHz$	-	9	-	pF

**Source-Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{SD}$	Forward On Voltage <sup>3</sup>	$I_S=10A, V_{GS}=0V$	-	-	1.5	V
$t_{rr}$	Reverse Recovery Time <sup>3</sup>	$I_S=10A, V_{GS}=0V,$	-	600	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt=100A/\mu s$	-	12	-	$\mu C$

**Notes:**

- 1.Pulse width limited by Max. junction temperature.
- 2.Starting  $T_j=25^{\circ}\text{C}$  ,  $V_{DD}=50V$  ,  $L=1.0mH$  ,  $R_G=25\Omega$  ,  $I_{AS}=10A$ .
- 3.Pulse test

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.

APEC RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN.

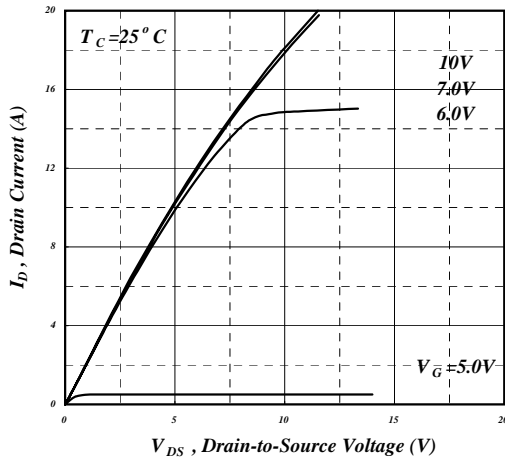


Fig 1. Typical Output Characteristics

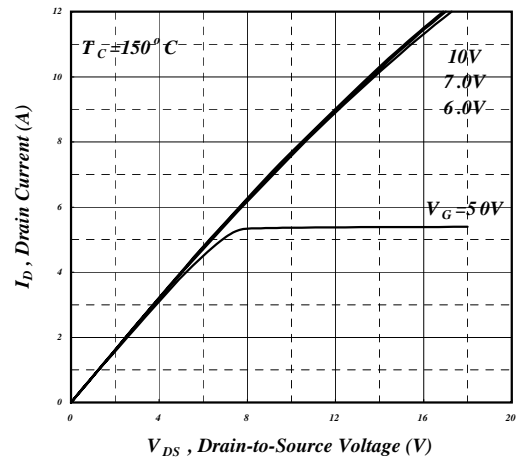


Fig 2. Typical Output Characteristics

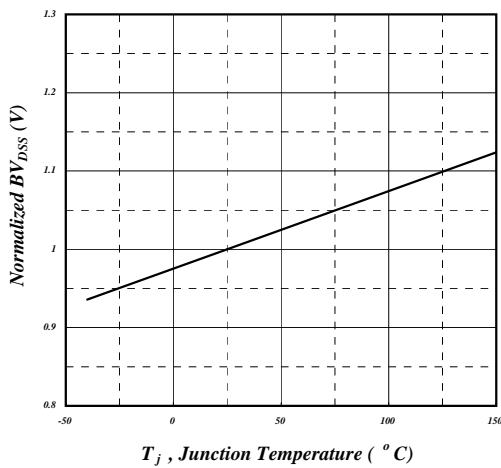


Fig 3. Normalized  $BV_{DSS}$  v.s. Junction Temperature

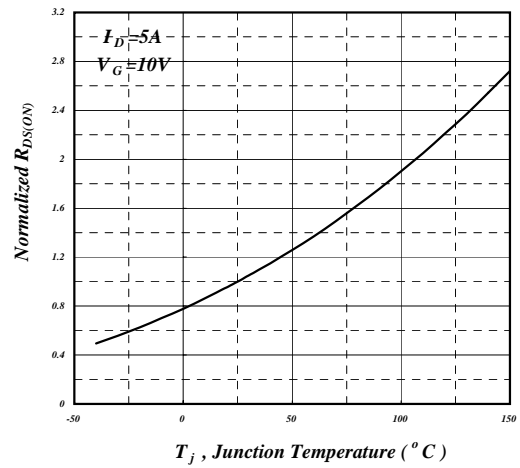


Fig 4. Normalized On-Resistance v.s. Junction Temperature

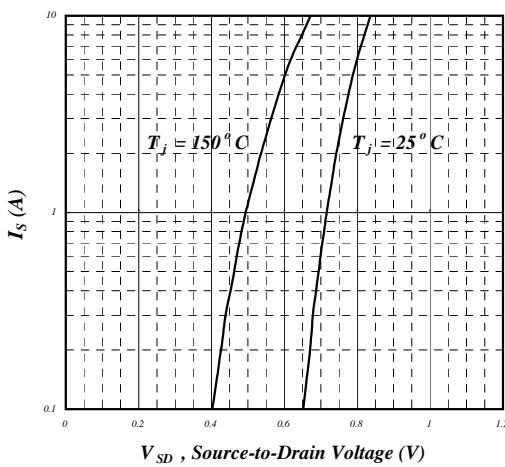


Fig 5. Forward Characteristic of Reverse Diode

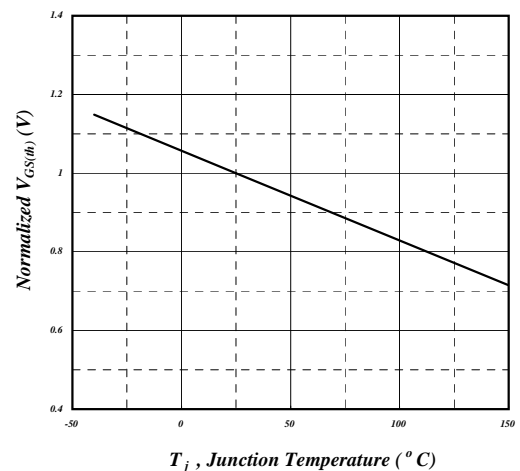


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

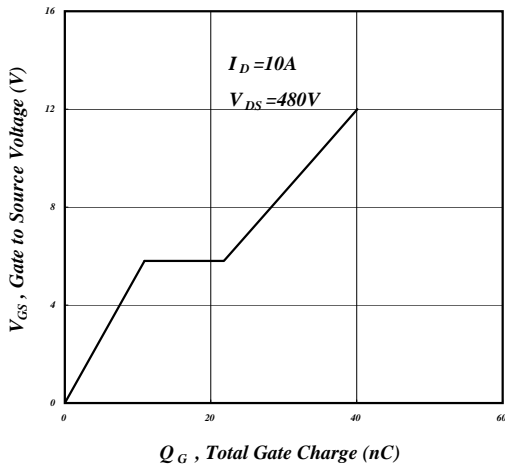


Fig 7. Gate Charge Characteristics

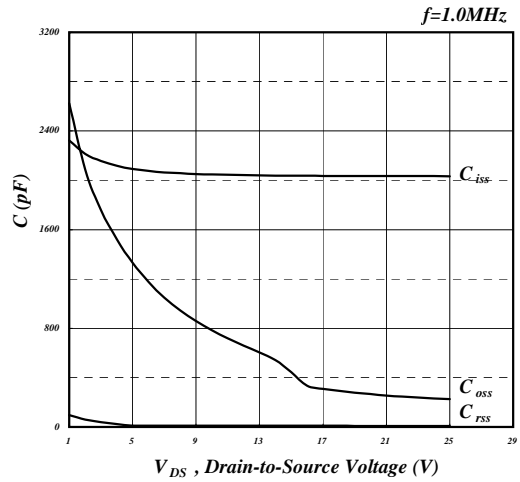


Fig 8. Typical Capacitance Characteristics

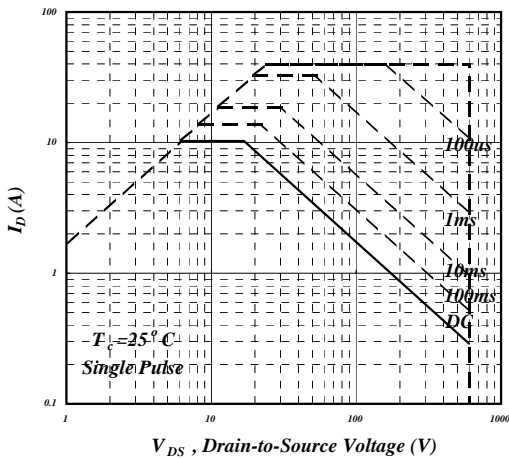


Fig 9. Maximum Safe Operating Area

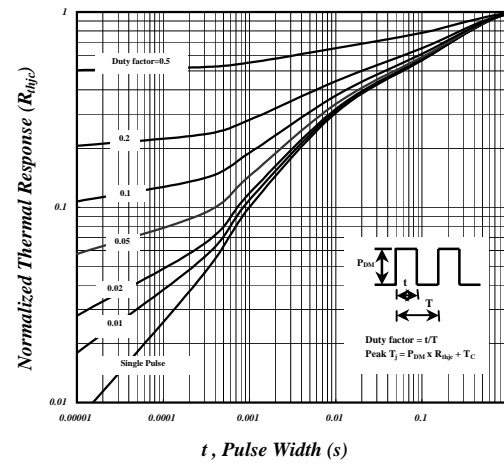


Fig 10. Effective Transient Thermal Impedance

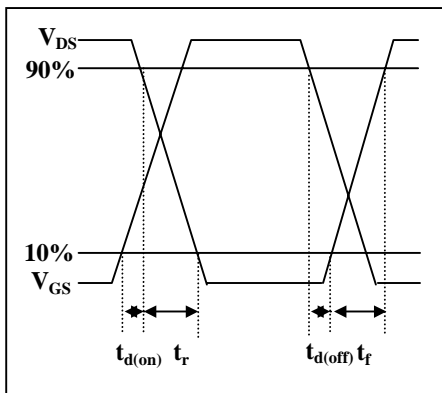


Fig 11. Switching Time Waveform

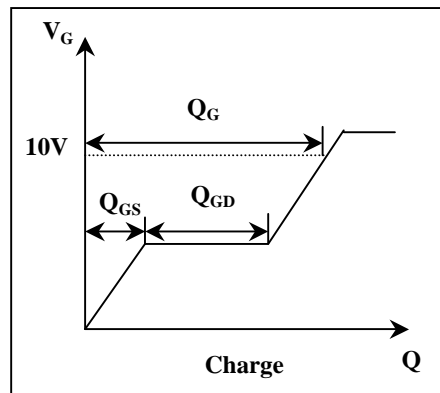
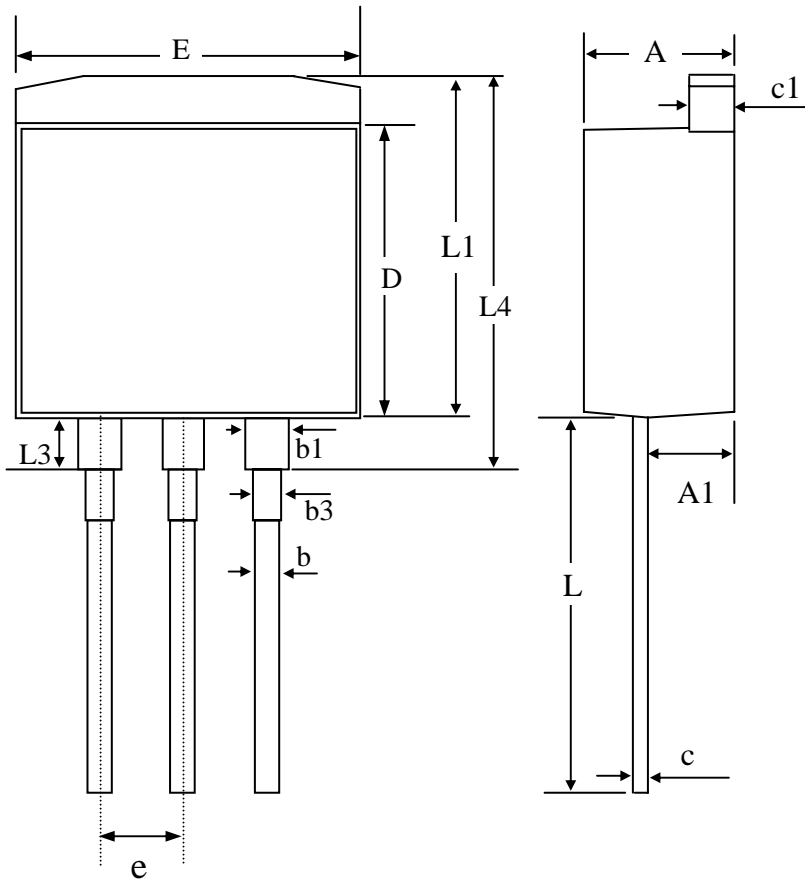


Fig 12. Gate Charge Waveform



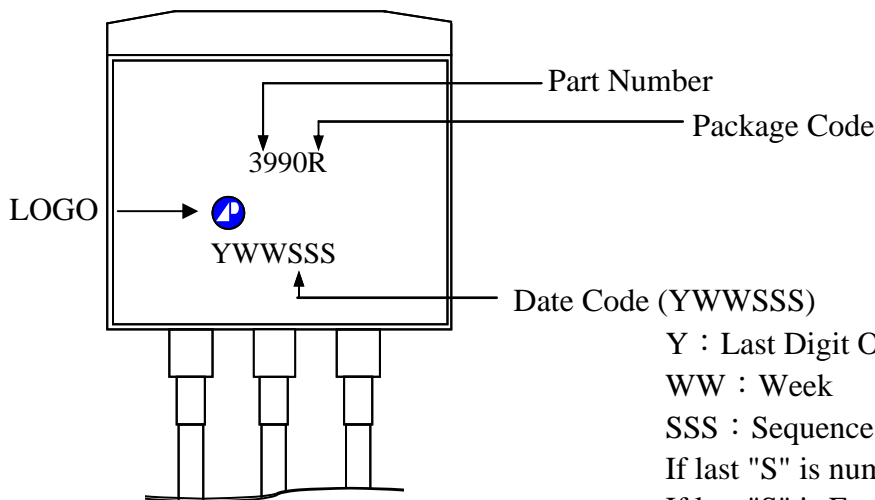
**Package Outline : TO-262**



SYMBOLS	Millimeters		
	MIN	NOM	MAX
A	4.24	4.44	4.64
A1	-----	-----	2.70
b	0.66	0.76	0.86
b1	1.07	1.27	1.47
b3	0.76	0.86	1.06
c	0.30	0.40	0.50
c1	1.15	1.30	1.45
D	8.30	8.60	8.90
E	9.90	10.20	10.50
e	2.04	2.54	3.04
L	10.50	11.00	11.50
L1	9.50	10.00	10.30
L3	----	1.30	----
L4	10.80	11.30	11.35

- 1.All Dimensions Are in Millimeters.
- 2.Dimension Does Not Include Mold Protrusions.

**Part Marking Information & Packing : TO-262**



Y : Last Digit Of The Year  
 WW : Week  
 SSS : Sequence  
 If last "S" is numerical letter : Rohs product  
 If last "S" is English letter : HF & Rohs product