N-Channel Enhancement Mode MOSFET

Feature

- 100V/230A
  $R_{DS(ON)}$=2.6mΩ (typ.) @ V_{GS} = 10V
- 100% Avalanche Tested
- Reliable and Rugged
- Lead-Free and Green Devices Available
  (RoHS Compliant)

Pin Description

Applications

- Power Switching application
- Uninterruptible Power Supply
- Motor Control

Ordering and Marking Information

Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
Common Ratings	(Unless Otherwise Noted)			
V_{DSS}	Drain-Source Voltage		100	V
V_{GSS}	Gate-Source Voltage		±20	V
T_J	Maximum Junction Temperature		175	°C
T_{STG}	Storage Temperature		-55 to 175	°C
I_S	Source Current-Continuous (Diode)	Tc=25°C	230	A
Mounted on Large Heat Sink				
I_{DM}	Pulsed Drain Current *	Tc=25°C	610	A
I_D	Continuous Drain Current	Tc=25°C	230	A
		Tc=100°C	162	A
P_D	Maximum Power Dissipation	Tc=25°C	300	W
		Tc=100°C	150	W
R_{JC}	Thermal Resistance, Junction-to-Case		0.5	°C/W
R_{JA}	Thermal Resistance, Junction-to-Ambient **		62	°C/W
E_{AS}	Single Pulsed-Avalanche Energy ***	L=0.3mH	980.7	mJ

Note: * Repetitive rating pulse width limited by max. junction temperature.
** Surface mounted on FR-4 board.
*** Limited by $T_J$max , starting T_J=25°C, L = 0.3mH, VDS=80V, VGS =10V.

Electrical Characteristics(Tc =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG028N10NS1 Min	Typ.	Max	Unit
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V,I_{DS}=250μA	100	-	-	V
I_{DSS}	Drain-to-Source Leakage Current	V_{DS}=100V,V_{GS}=0V	-	-	1.0	μA
		T_J=125°C	-	-	50	μA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250μA	2	3	4	V
I_{GSS}	Gate-Source Leakage Current	V_{GS}				

Electrical Characteristics (Cont.) (Tc =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG028N10NS1			Unit
			Min	Typ.	Max	
Dynamic Characteristics						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	-	2.8	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, Frequency=1.0MHz	-	10320	-	pF
C_{oss}	Output Capacitance		-	3454	-	
C_{rss}	Reverse Transfer Capacitance		-	242	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=50V,R_G=2.5Ω, I_{DS}=50A,V_{GS}=10V	-	27.3	-	ns
T_r	Turn-on Rise Time		-	103.7	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	92.8	-	
T_f	Turn-off Fall Time		-	100.8	-	
Gate Charge Characteristics						
Q_g	Total Gate Charge	V_{DS}=80V, V_{GS}=10V I_D=50A	-	176	-	nC
Q_{gs}	Gate-Source Charge		-	56	-	
Q_{gd}	Gate-Drain Charge		-	48	-	

Note: *Pulse test pulse width ≤ 300us duty cycle ≤ 2%

Typical Operating Characteristics

Figure 1: Power Dissipation

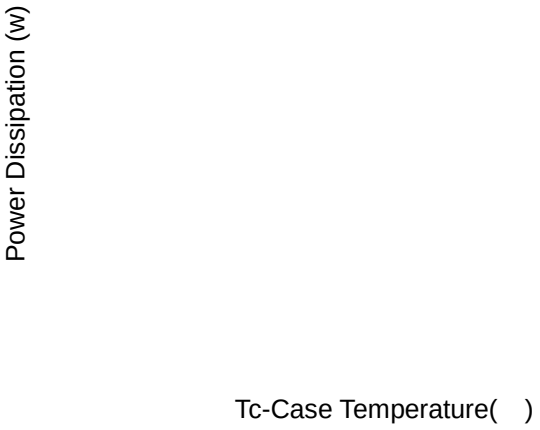


Figure 2: Drain Current

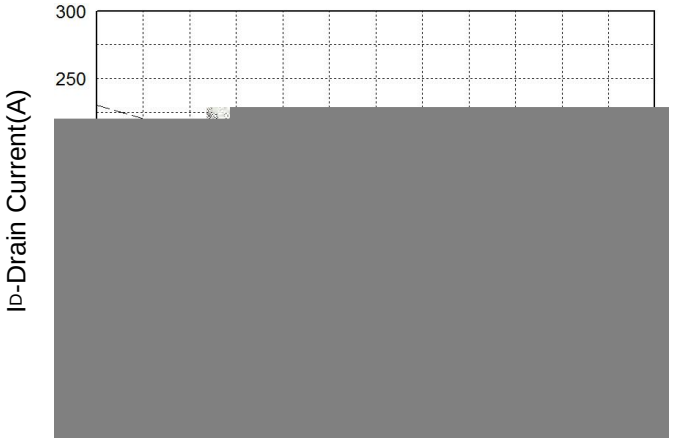
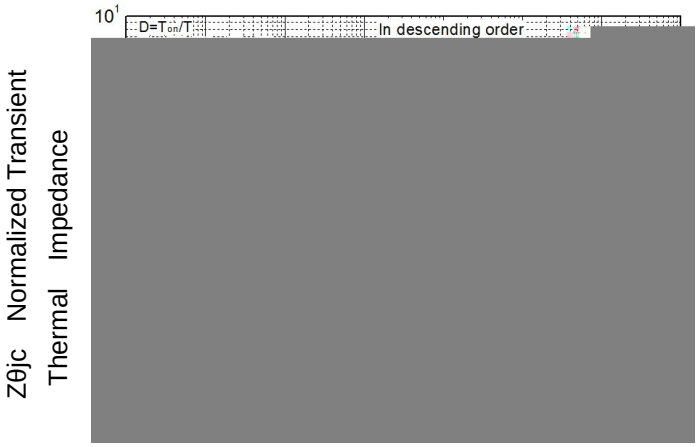


Figure 3: Safe Operation Area

Figure 4: Thermal Transient Impedance



Maximum Effective Transient Thermal Impedance, Junction-to-Case

Figure 5: Output Characteristics

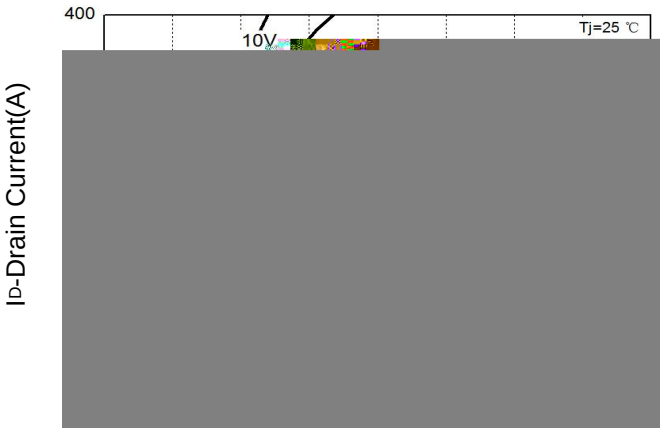
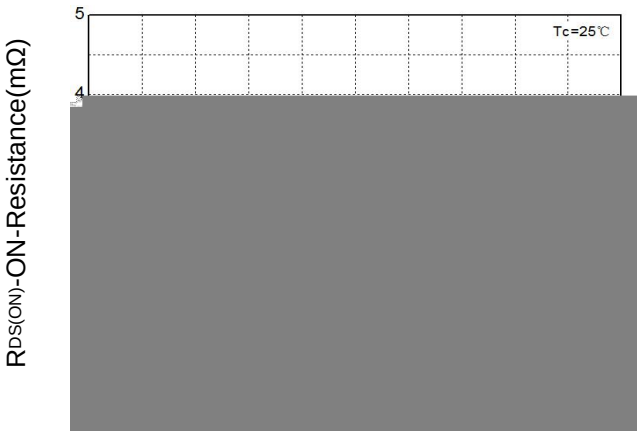


Figure 6: Drain-Source On Resistance



Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

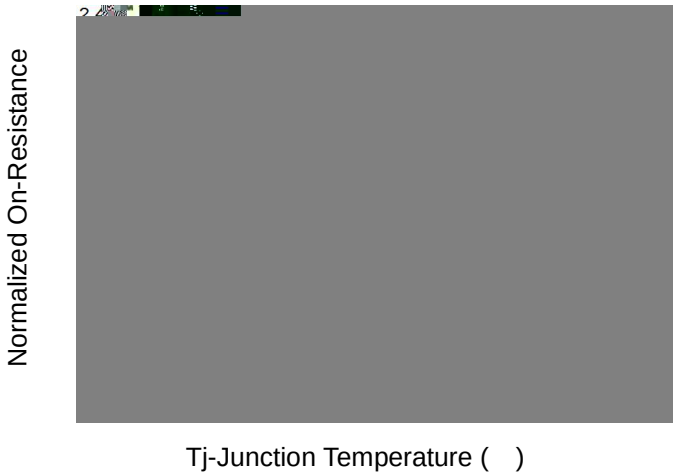


Figure 8: Source-Drain Diode Forward

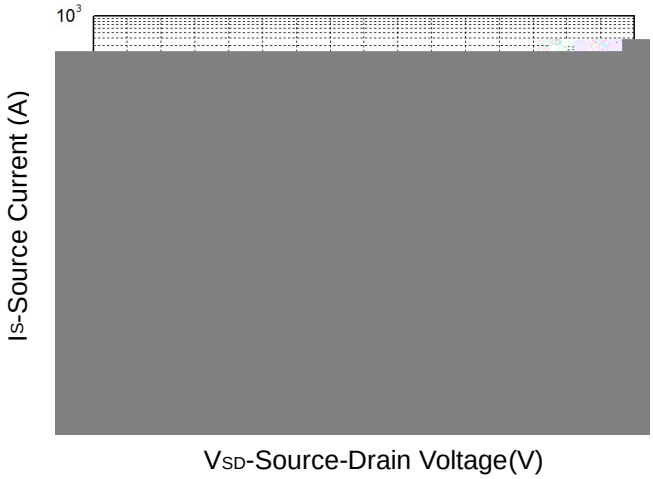
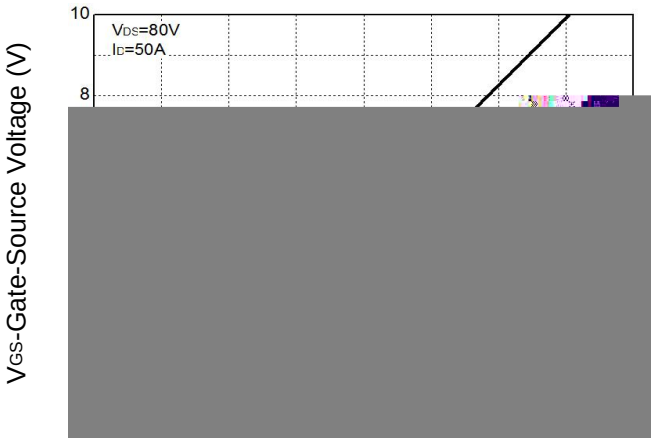
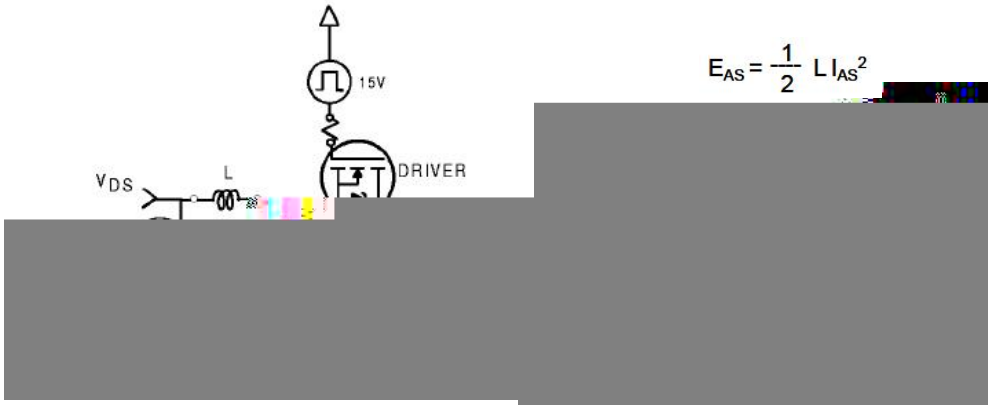


Figure 9: Capacitance Characteristics

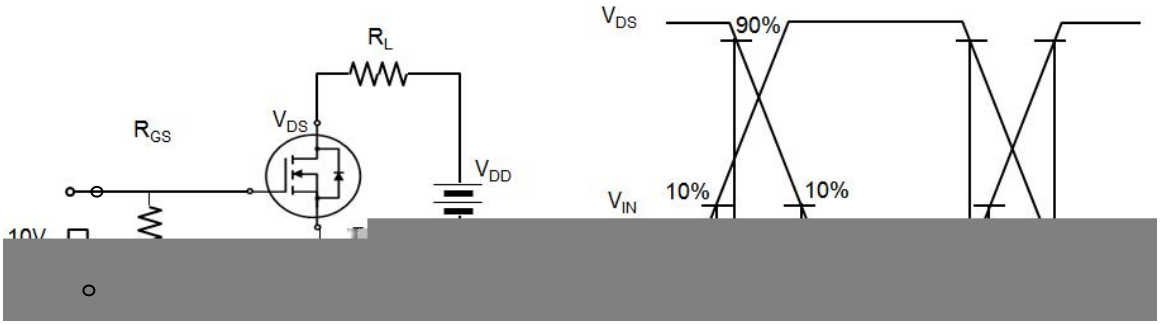
Figure 10: Gate Charge Characteristics



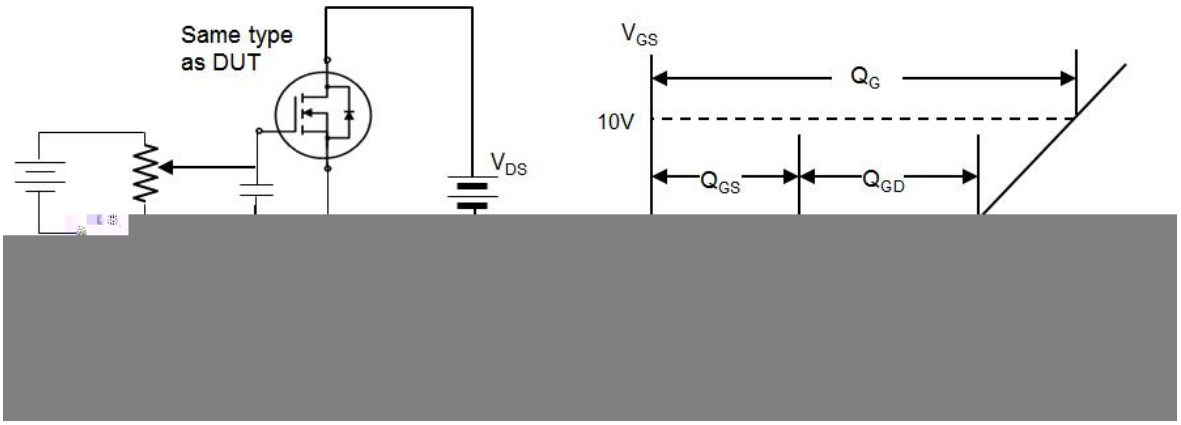
Avalanche Test Circuit



Switching Time Test Circuit



Gate Charge Test Circuit

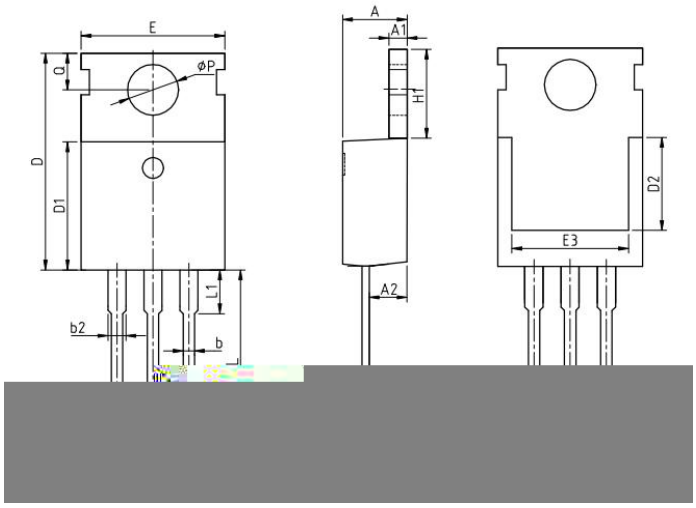


Device Per Unit

Package Type	Unit	Quantity
TO-220FB-3L	Tube	50
TO-263-2L	Tube	50
TO-263-2L	Reel	800

Package Information

TO-220FB-3L

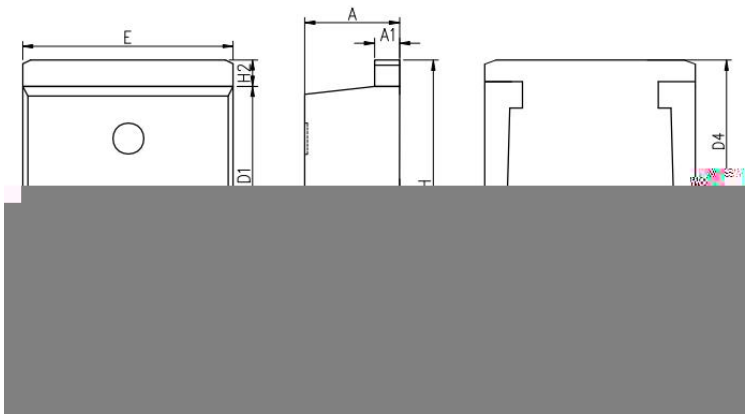


COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.25	1.30	1.45
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.40	0.50	0.65
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00

Package Information

TO-263-2L



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0	0.13	0.25
b	0.7	0.81	0.96
b1	1.17	1.27	1.47
c	0.3	0.38	0.53
D1	8.5	8.7	8.9
D4	6.6	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54 BSC		
H	14.7	15.1	15.5
H2	1.07	1.27	1.47
L	2	2.3	2.6
L1	1.4	1.55	1.7
L4	0.25 BSC		
θ	0°	5°	9°

Classification Profile

Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (T_{smin}) Temperature max (T_{smax}) Time (Tsmin to Tsmax) (t_s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate ($T_{smax}$to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L) Time at liquidous (t_L)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body Temperature (T_p)*	See Classification Temp in table 1	SeeClassification Tempin table 2
Time (t_P)** within 5°C of the specified classification temperature (T_c)	20** seconds	30** seconds
Average ramp-down rate ($T_p$to T_{smax})	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
*Tolerance for peak profile Temperature (T_p) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.		

Table 1.SnPb Eutectic Process – Classification Temperatures (Tc)

Package Thickness	Volume mm³ <350	Volume mm³ ≥ 350
2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2.Pb-free Process – Classification Temperatures (Tc)

Package Thickness	Volume mm³ <350	Volume mm³ 350-2000	Volume mm³ ≥ 2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥ 2.5 mm	250 °C	245 °C	245 °C

Reliability Test Program

Test item	Method	Description