General Description

The DY 20N60WS is a high voltage power MOSFET, fabricated using advanced super junction technology. The resulting device has extremely low on resistance, low gate charge and fast switching time, making it especially suitable for applications which require superior power density and outstanding efficiency.

The 20N60WS break down voltage is 600V and it has a high rugged avalanche characteristics. The 20N60WS is available in TO-263,ITO-220, TO-220,TO-262packages.

Features

- Ultra Low $R_{DS(ON)}$ = 200mΩ @ V_{GS} = 10V.
- Ultra Low Gate Charge, Qg=25.3nC typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved

Application

- LED Lighting Power
- TV Power
- High Power AC/DC Power Supply

Part No.	Package	Packing
DMT20N60WS-TU	TO-220	50pcs / Tube
DMF20N60WS-TU	ITO-220	50pcs / Tube
DMK20N60WS-TU	TO-262	50pcs / Tube
DMG20N60WS-TU	TO-263	50pcs / Tube
DMG20N60WS-TR	TO-263	800pcs / 13" Reel

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$(Ω)
600	0.19@ V_{GS} =10V

Symbol

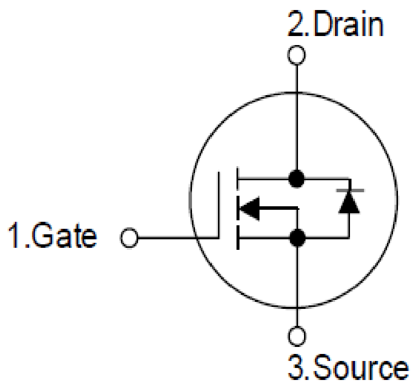
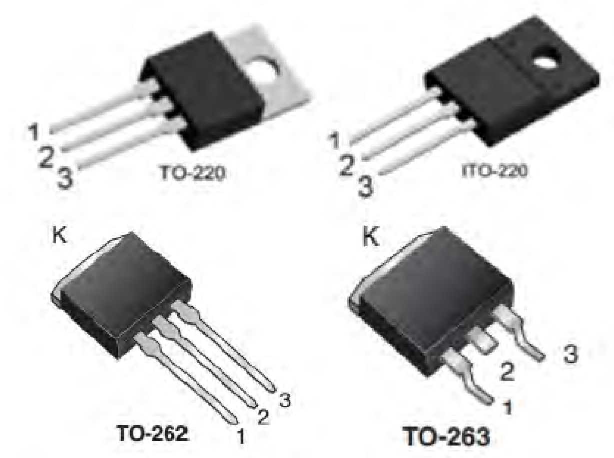


Figure 1 Symbol of 20N60WS

Package Type



Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	630	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current	T_C=25ºC	I_D	14.0	A
	T_C=125ºC		7.1	
Pulsed Drain Current (Note 2)		I_{DM}	43	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	190	mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	0.2	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	4.0	A
Continuous Diode Forward Current		I_S	16.0	A
Diode Pulse Current		$I_{S.PULSE}$	43	A
Operating Junction Temperature		T_J	150	ºC
Storage Temperature		T_{STG}	-55 to 150	ºC
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	300	ºC

Note:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. I_{AS} = 4.0A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C

Electrical Characteristics

T_J = 25℃, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250uA	600			V
Zero Gate Voltage Drain Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			1	uA
Gate-Body Leakage Current	Forward	I_{GSSF}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse	I_{GSSR}	V_{GS}=-30V, V_{DS}=0V			-100	
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250uA	3		5	V
Static Drain-Source On-Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=9.0A		170	190	mΩ
Gate Resistance		R_G	f=1MHz, Open Drain		2.0		Ω
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS}=50V, V_{GS}=0V, f=1MHz		1093		pF
Output Capacitance		C_{OSS}			86.4		
Reverse Transfer Capacitance		C_{RSS}			10		
Effective output capacitance, energy related NOTE4		$C_{O(er)}$	V_{GS}=0V, V_{DS}=0…480V		51.2		pF
Effective output capacitance, time related NOTE5		$C_{O(tr)}$			187.3		
Turn-on Delay Time		$t_{d(on)}$	V_{DD}=400V, I_D=7.0A R_G=10Ω, V_{GS}=10V		12		ns
Rise Time		t_r			20		
Turn-off Delay Time		$t_{d(off)}$			24		
Fall Time		t_f			50		
Gate Charge Characteristics							
Gate to Source Charge		Q_{gs}	V_{DD}=480V, I_D=7.0A V_{GS}=0 to 10V		7.2		nC
Gate to Drain Charge		Q_{gd}			8.1		
Gate Charge Total		Q_g			25.3		
Gate Plateau Voltage		$V_{plateau}$			5.4		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_{SD}=7.0A		0.81	1.1	V
Reverse Recovery Time		t_{rr}	V_R=400V, I_F=7.0A dI_F/dt=100A/us		216.9		ns
Reverse Recovery Charge		Q_{rr}			1.7		uC
Peak Reverse Recovery Current		I_{rrm}			16.1		A

Note:

4. $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 480V

5. $C_{O\ (tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480 V

Typical Performance Characteristics

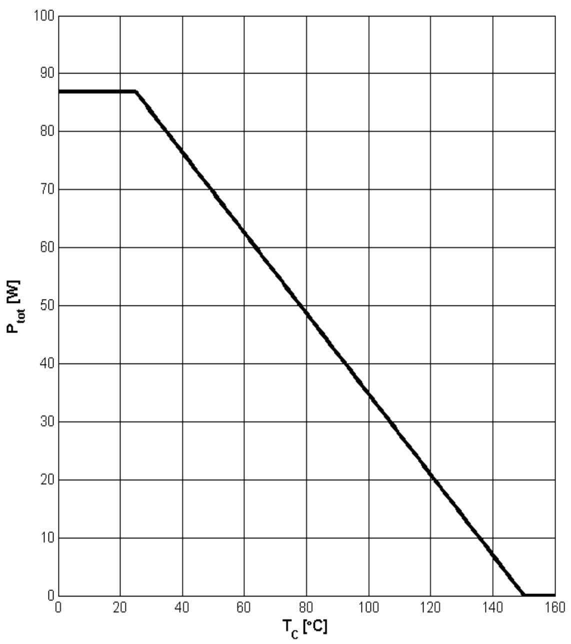
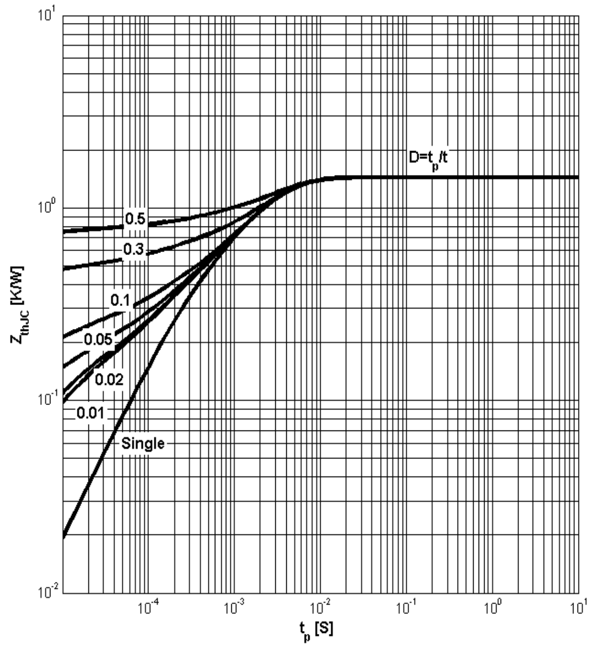
Figure 3: Power Dissipation	Figure 4: Max. Transient Thermal Impedance
	
$P_{tot} = f(T_c)$	$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$

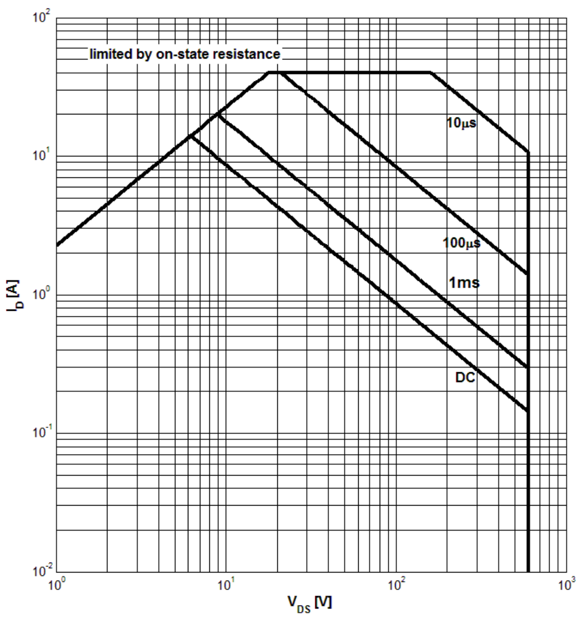
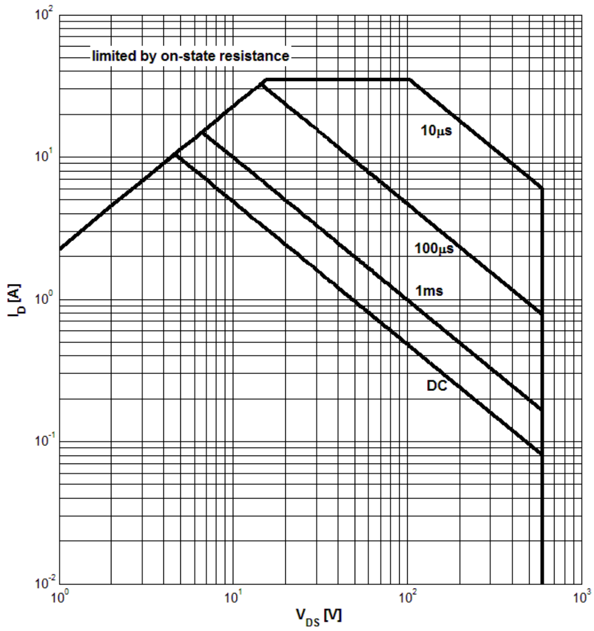
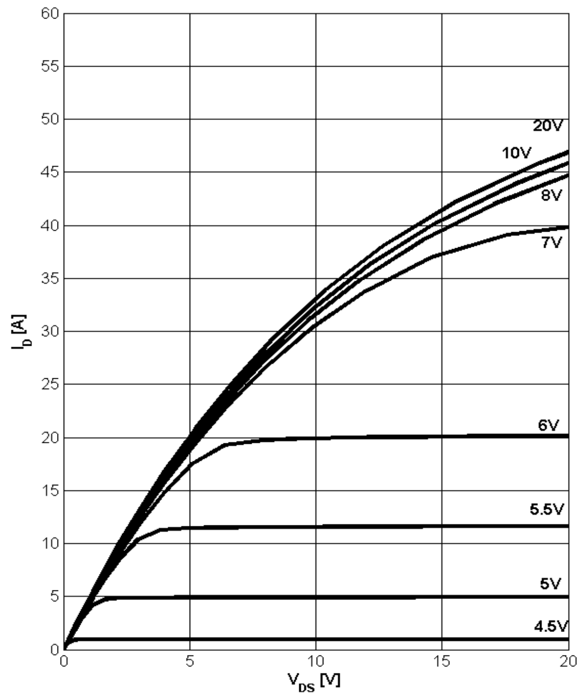
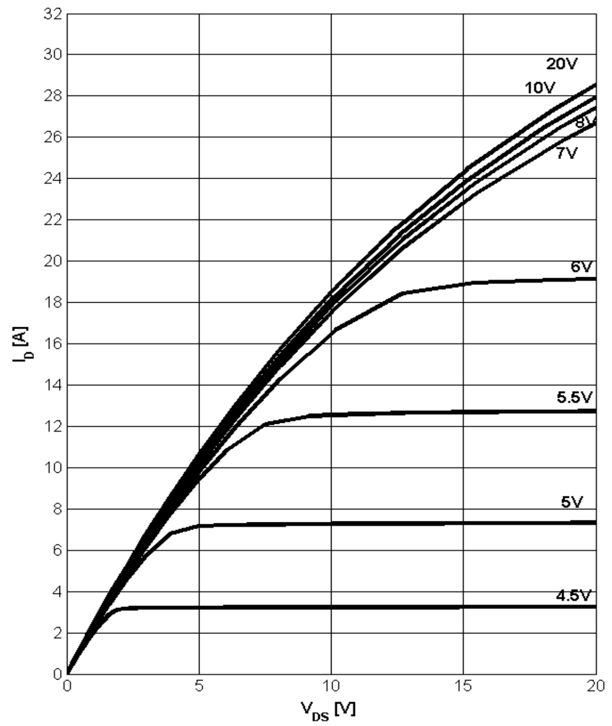
Figure 5: Safe Operating Area	Figure 6: Safe Operating Area
	
$I_D = f(V_{DS})$; T_c= 25ºC; V_{GS}>7V; parameter t_p	$I_D = f(V_{DS})$; T_c= 80ºC; V_{GS}>7V; parameter t_p

Figure 7: Typ. Output Characteristics



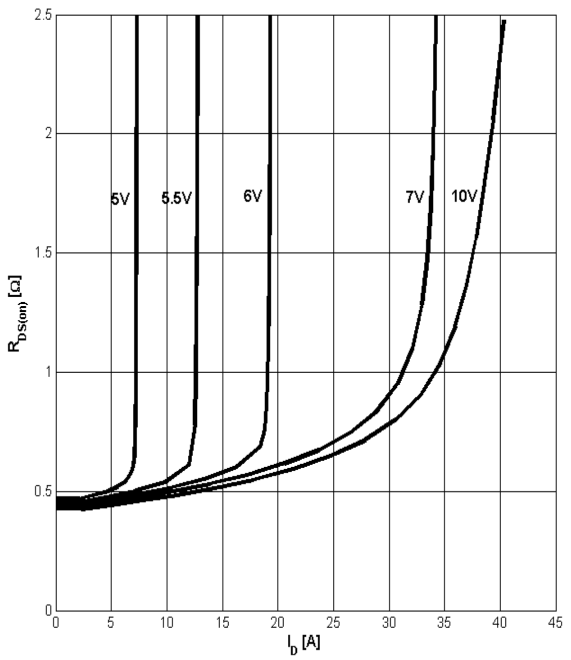
$I_D = f(V_{DS})$; Tj= 25ºC; parameter: V_{GS}

Figure 8: Typ. Output Characteristics



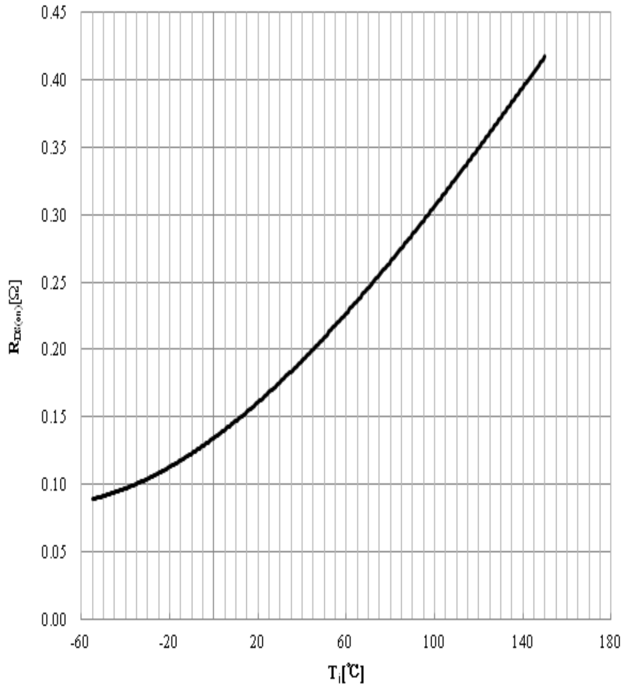
$I_D = f(V_{DS})$; T_j= 125ºC; parameter: V_{GS}

Figure 9: Typ. Drain-Source On-State Resistance



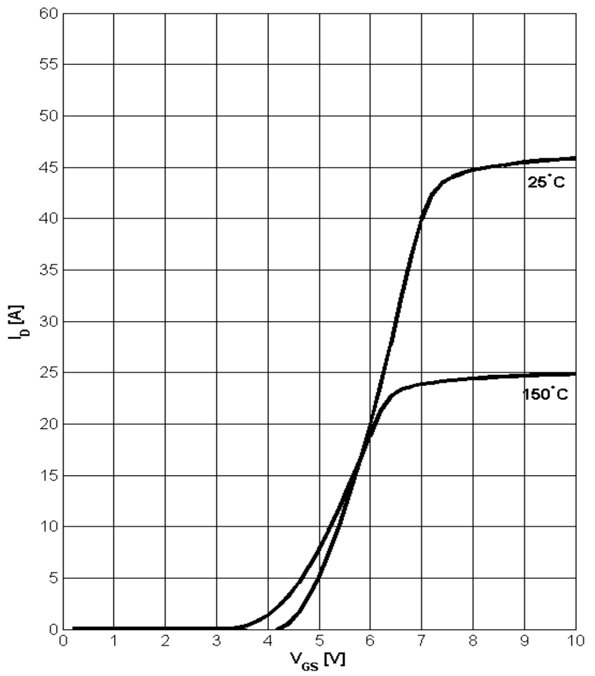
$R_{DS(ON)}$ =f(I_D); T_j=125ºC; parameter: V_{GS}

Figure 10: Typ. Drain-Source On-State Resistance



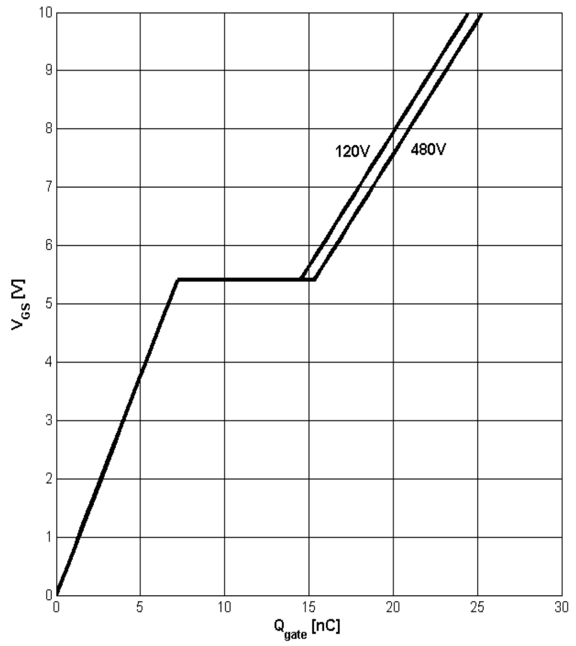
$R_{DS(ON)}$=f(T_j); I_D=9.0A; V_{GS}=10V

Figure 11: Typ. Transfer Characteristics



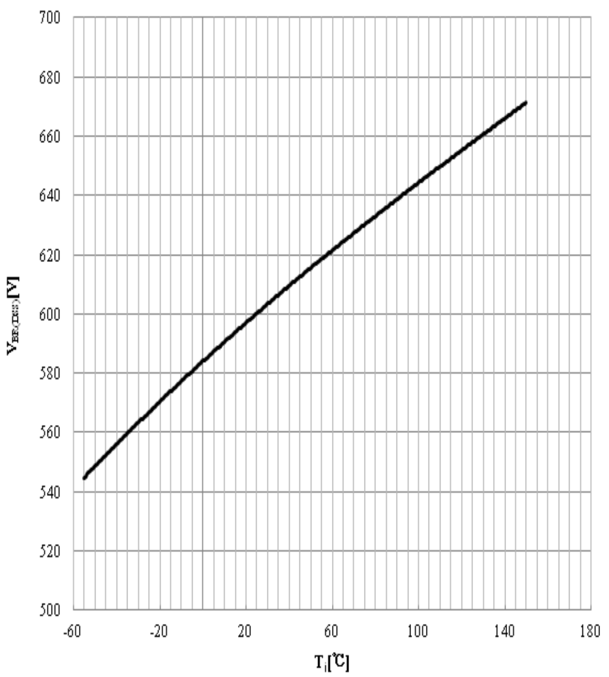
$I_D = f(V_{GS})$; $V_{DS} = 20V$

Figure 12: Typ. Gate Charge



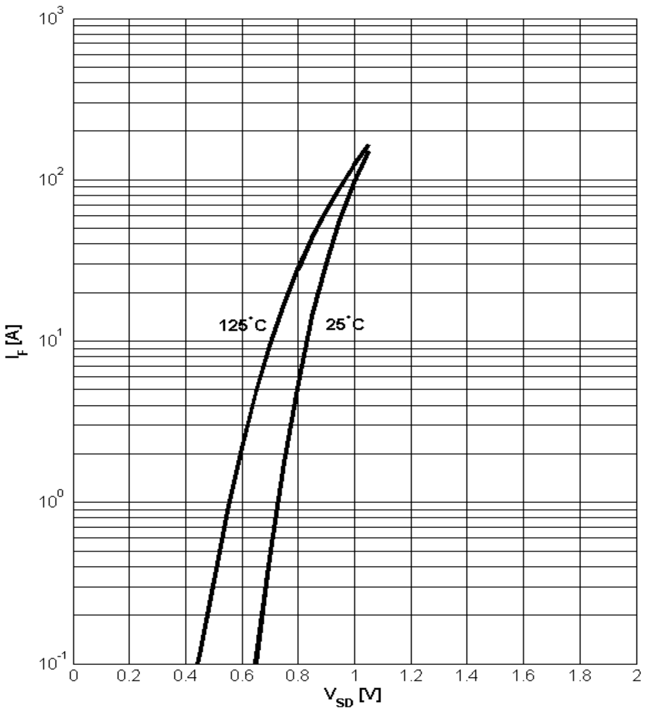
$V_{GS}= f(Q_{gate})$, $I_D= 7A$ pulsed

Figure 13: Drain-Source Breakdown Voltage



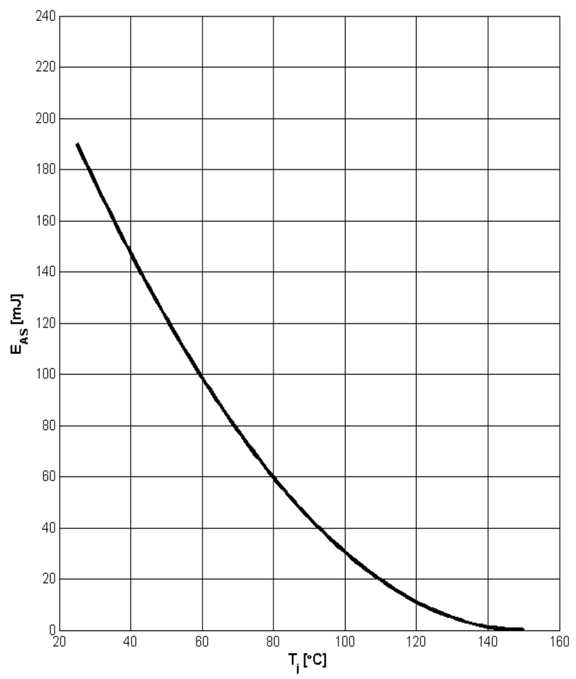
$V_{BR(DSS)}=f(T_j)$; I_D=1mA

Figure 14: Forward Characteristics of Reverse Diode



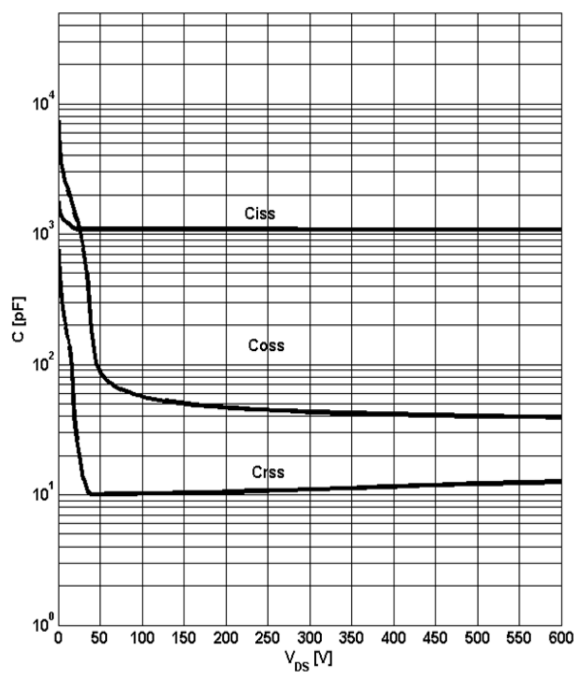
$I_F=f(V_{SD})$; parameter: T_j

Figure 15: Avalanche Energy



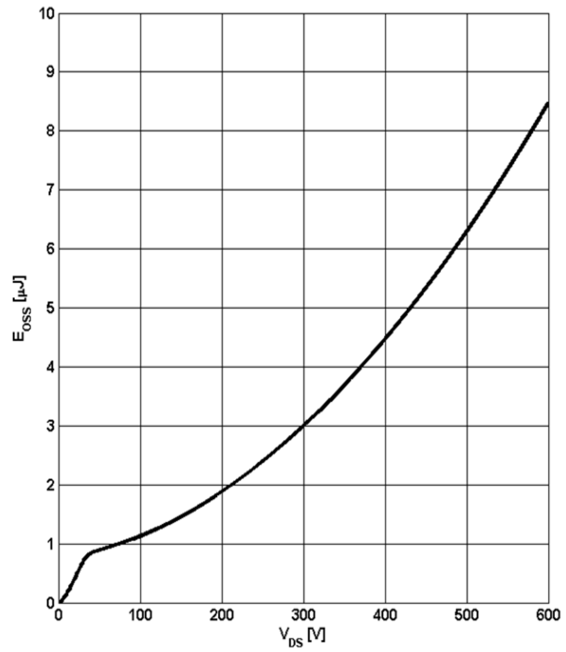
E_{AS}=f(T_j); I_D=4.0A; V_{DD}=60V

Figure 16: Typ. Capacitances



C=f(V_{DS}); V_{GS}=0; f=1MHz

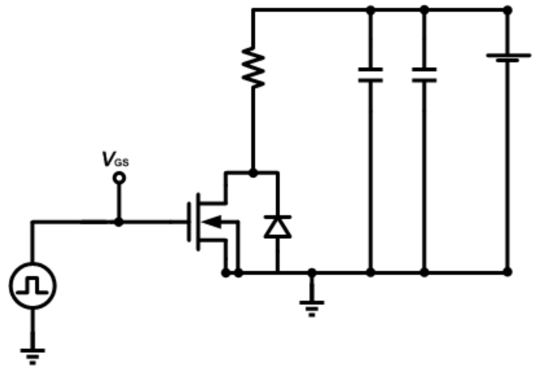
Figure 17: C_{OSS} Stored Energy

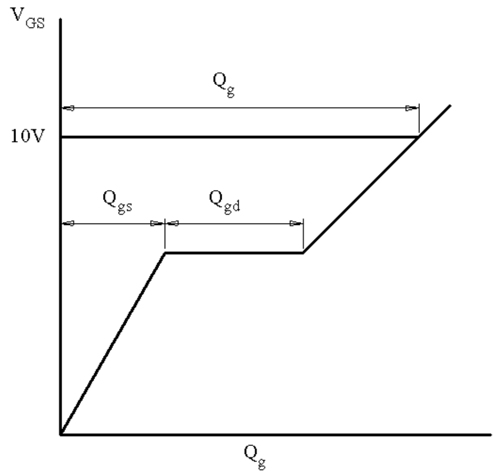


E_{OSS}=f(V_{DS})

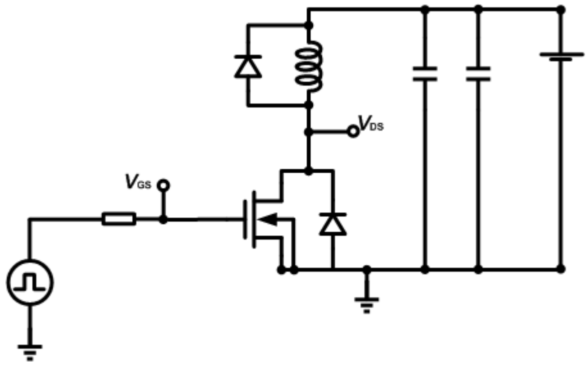
Test Circuits

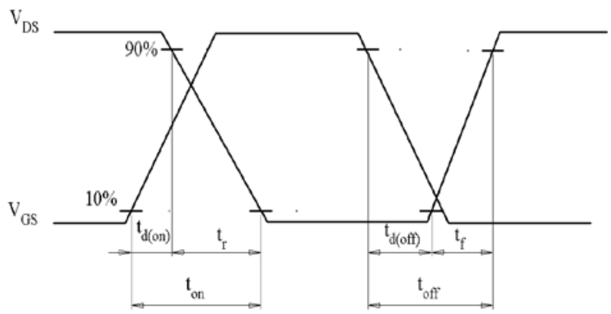
1. Gate Charge Test Circuit & Waveform



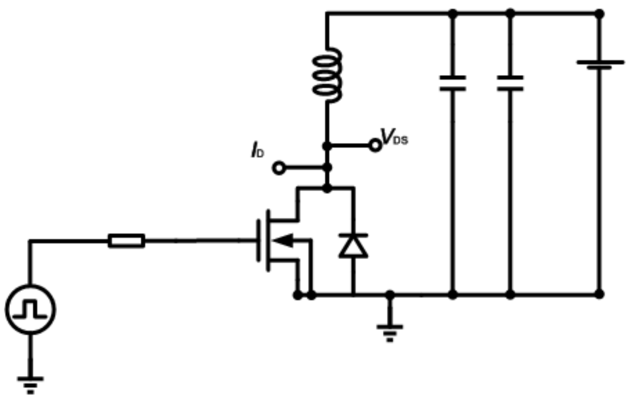


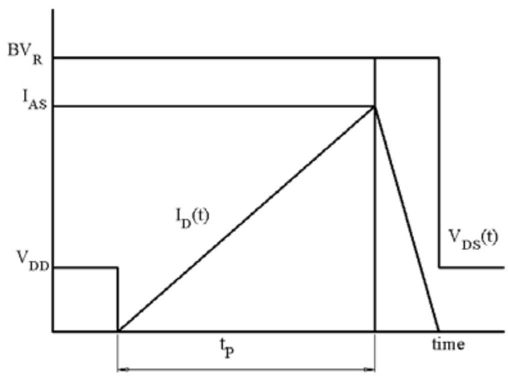
2. Switch Time Test Circuit



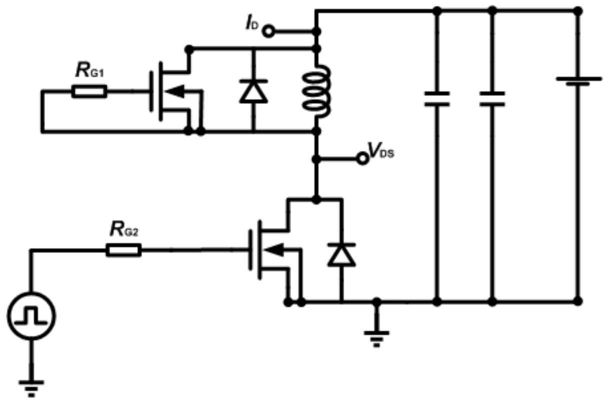


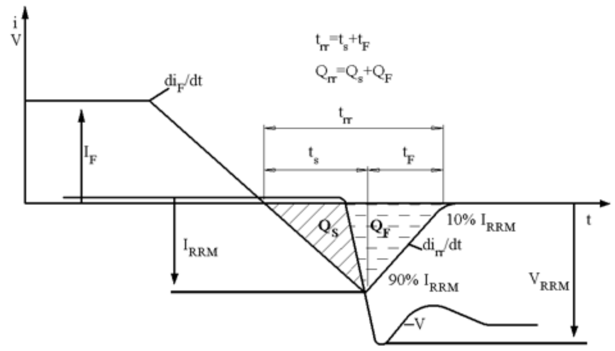
3. Unclaimed Inductive Switching Test Circuit & Waveforms



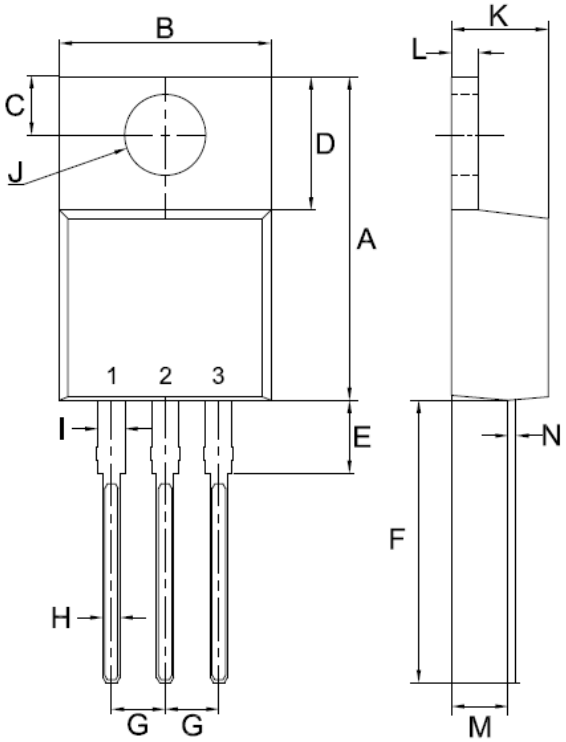


4. Test Circuit and Waveform for Diode Characteristics



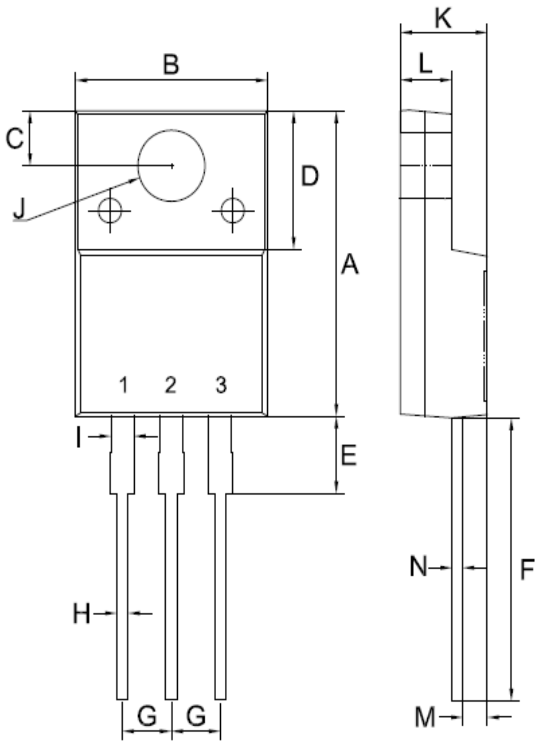


TO-220 Mechanical Drawing



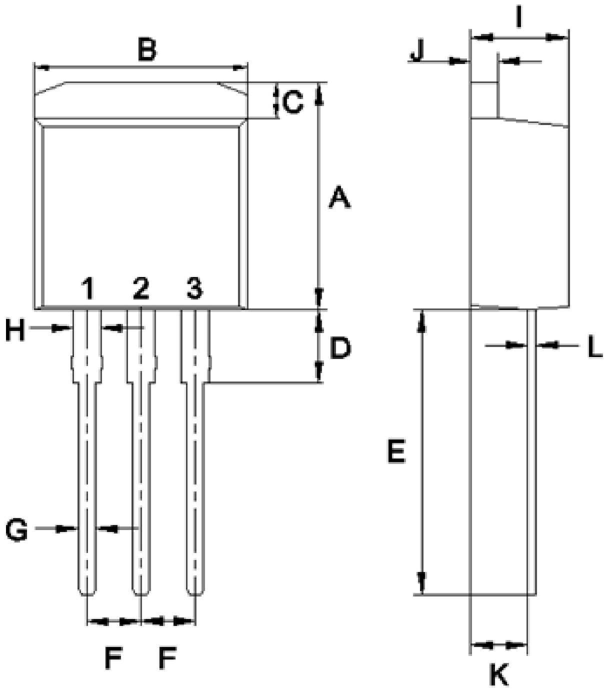
TO−220AB Unit:mm		
DIM	MIN	MAX
A	14.80	15.80
B	9.57	10.57
C	2.54	2.94
D	5.80	6.80
E	2.95	3.95
F	12.70	13.40
G	2.34	2.74
H	0.51	1.11
I	0.97	1.57
J	3.54ϕ	4.14ϕ
K	4.27	4.87
L	1.07	1.47
M	2.03	2.92
N	0.30	0.64

ITO-220 Mechanical Drawing



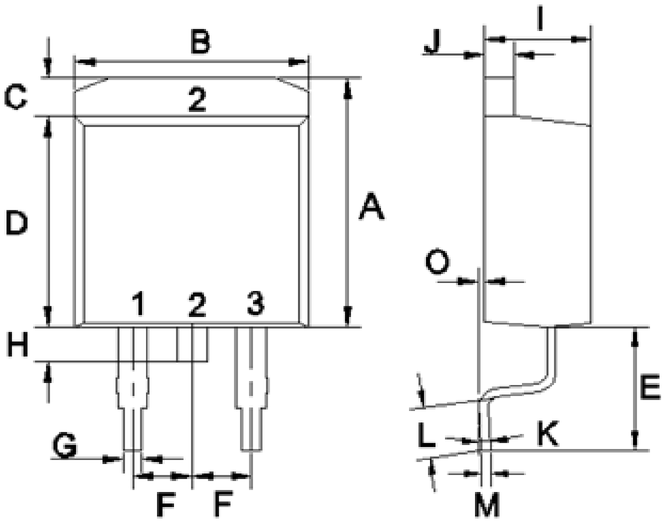
ITO-220AB Unit:mm		
DIM	MIN	MAX
A	14.50	15.50
B	9.50	10.50
C	2.50	2.90
D	6.30	7.30
E	3.30	4.30
F	13.00	14.00
G	2.35	2.75
H	0.30	0.90
I	0.90	1.50
J	3.20	3.80
K	4.24	4.84
L	2.52	2.92
M	1.09	1.49
N	0.47	0.64

TO-262 Mechanical Drawing



TO-262(I²PAK) Unit:mm		
DIM	MIN	MAX
A	10.14	11.14
B	9.57	10.57
C	1.44	1.84
D	2.95	3.95
E	12.70	13.40
F	2.34	2.74
G	0.51	1.11
H	0.97	1.57
I	4.27	4.87
J	1.07	1.47
K	2.03	2.92
L	0.30	0.46

TO-263 Mechanical Drawing



TO-263 (D² PAK) Unit:mm		
DIM	MIN	MAX
A	10.44	10.84
B	9.81	10.21
C	1.44	1.84
D	8.80	9.20
E	4.46	4.66
F	2.44	2.64
G	0.61	1.01
H	0.70	1.30
I	4.27	4.87
J	1.07	1.47
K	0°	8°
L	2.10	2.50
M	0.30	0.46
O	0	0.25