Product Summary

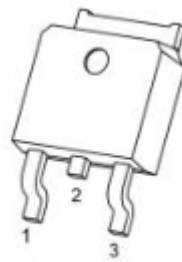| $V_{(BR)DSS}$	$R_{DS(on)TYP}$	I_D
20V	4.1mΩ@4.5V	70A

Feature

- V_{DS} =20V, I_D =90A
- $R_{DS(ON)}$ <6mΩ @ V_{GS}=4.5V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
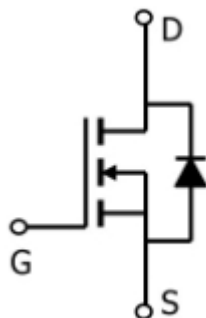
Applications

- Load switching
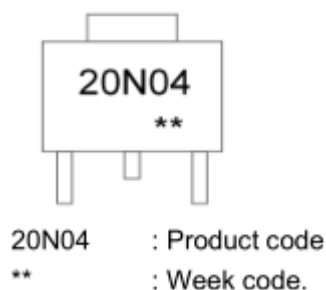- Hard switched and high frequency circuits
- Uninterruptible power supply

Package

TO-252(G:1 D:2 S:3)

Circuit diagram

Marking

20N04 : Product code

** : Week code.

Absolute maximum ratings

(T_a=25℃ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	±12	V
Drain Current-Continuous	I_D	70	A
Drain Current-Continuous (T_C=100℃)	$I_{D(100℃)}$	49	A
Pulsed Drain Current[1]	I_{DM}	280	A
Maximum Power Dissipation	P_D	60	W
Derating factor		0.48	W/℃
Single pulse avalanche energy (Note 5)	E_{AS}	200	mJ
Thermal Resistance,Junction-to-Case(Note 2)	$R_{θJC}$	2.1	℃/W
Operating Junction and Storage Temperature Range	T_J, $T_{STG,}$	-55 To 150	℃

Electrical characteristics

(T_A=25℃, unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static Characteristics						
Drain-source breakdown voltage	BV_{DSS}	V_{GS} = 0V, I_D =250μA	20			V
Zero gate voltage drain current	I_{DSS}	V_{DS} =20V, V_{GS} = 0V			1	uA
Gate-body leakage current	I_{GSS}	V_{GS} =±12V , V_{DS}=0V			±100	uA
On Characteristics(Note 3)						
Gate threshold voltage	$V_{GS(th)}$	V_{DS} =V_{GS}, I_D =250μA	0.5	0.75	1	V
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} =4.5V, I_D =20A		4.1	6	mΩ
		V_{GS} =2.5V, I_D =15A		5.7	9	
Forward Transconductance	g_{FS}	V_{DS} =10V, I_D =20A	15			S
Dynamic characteristics(Note 4)						
Input Capacitance	C_{iss}	V_{DS}=10V, V_{GS}=0V, f=1MHz		2000		pF
Output Capacitance	C_{oss}			500		
Reverse Transfer Capacitance	C_{rss}			200		
Switching Characteristics(Note 4)						
Turn-On Delay Time	$T_{d(on)}$	V_{DD}=10V, I_D=2A, R_L=1Ω, V_{GS}=4.5V, R_G=3Ω		6.4		nS
Rise Time	T_r			17.2		
Turn-Off Delay Time	$T_{d(off)}$			29.6		
Fall Time	T_f			16.8		
Total Gate Charge(4.5V)	Q_g	V_{DS}=10V, I_D=20A, V_{GS}=10V		27		nC
Gate-Source Charge	Q_{gS}			6.5		
Gate-Drain Charge	Q_{gd}			6.4		
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	I_S=10A, V_{GS} = 0V			1.2	V
Diode Forward Current (Note 2)	I_S				60	A
Reverse Recovery Time	t_{rr}	T_J = 25℃, I_F = 20A di/dt =100A/μs(Note3)		25		nS
Reverse Recovery Charge	Q_{rr}			24		nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

Notes:

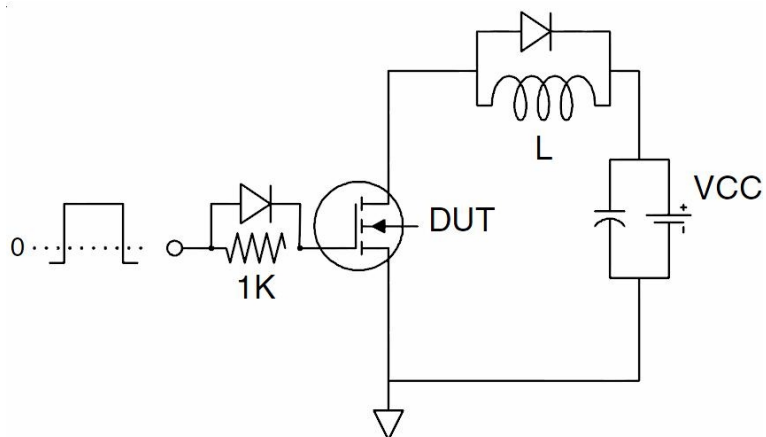1. Repetitive Rating: Pulse width limited by maximum junction temperature.

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

3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.

4. Guaranteed by design, not subject to production

5. EAS condition : T_j=25℃,V_{DD}=10V,V_G=10V,L=0.5mH,Rg=25Ω,

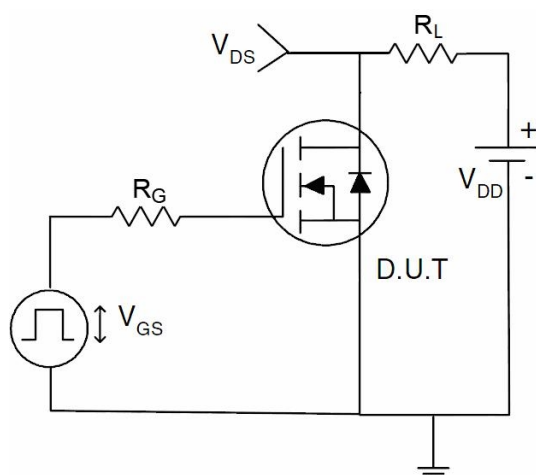# Typical Characteristics

- EAS Test Circuits

- Gate Charge Test Circuit
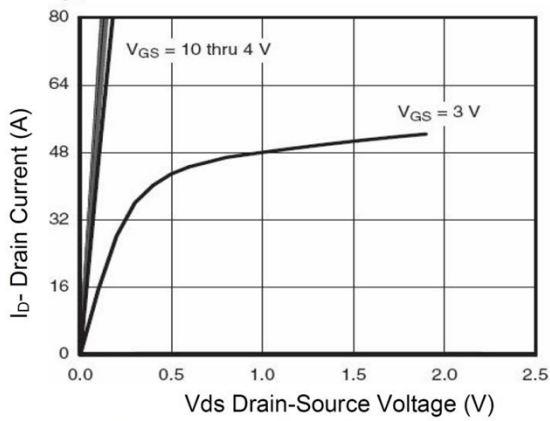

- Switch Time Test Circuit

Typical Characteristics
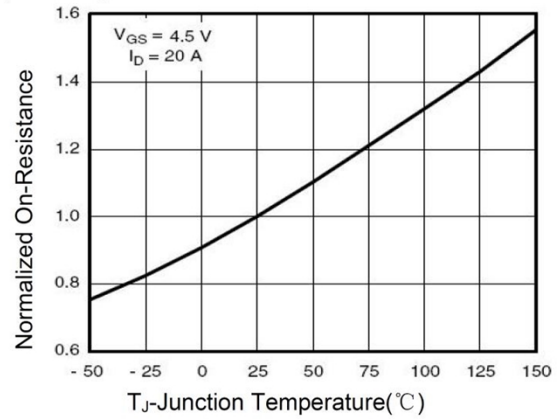

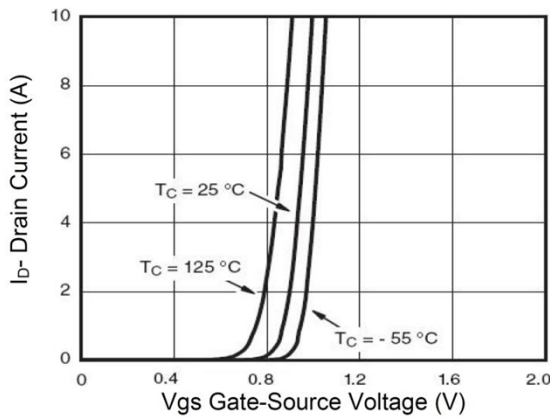**Figure 1 Output Characteristics**

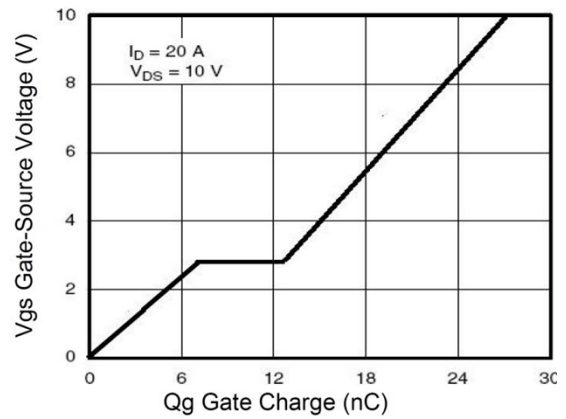**Figure 4 Rdson-JunctionTemperature**

Figure 2 Transfer Characteristics

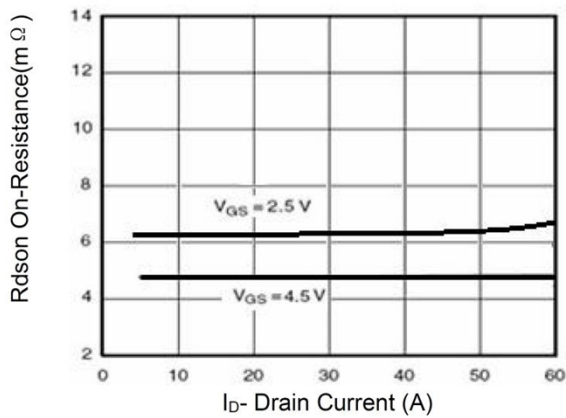**Figure 5 Gate Charge**
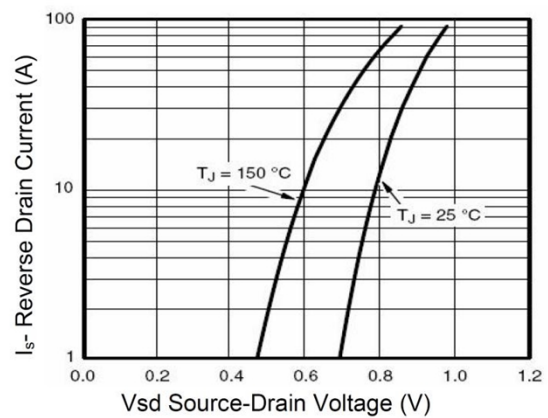

Figure 3 Rdson- Drain Current
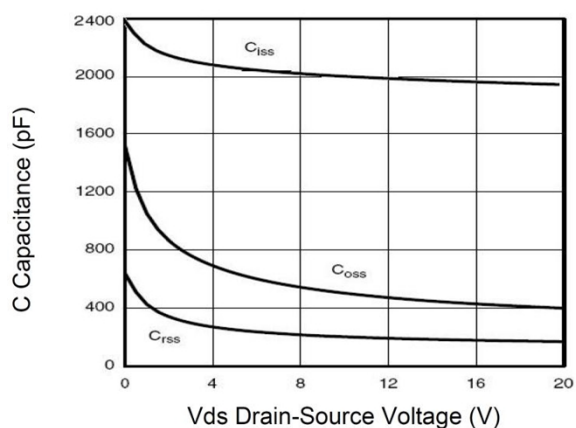

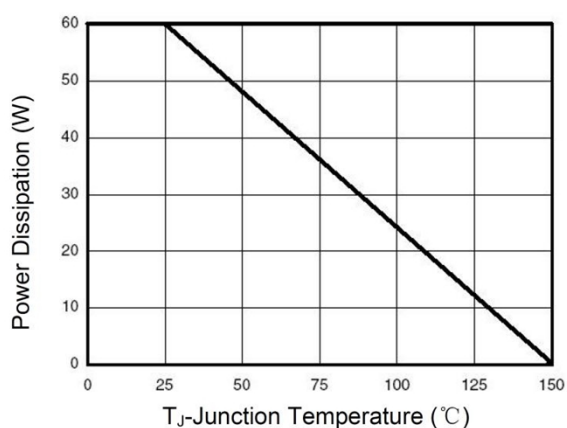**Figure 6 Source- Drain Diode Forward**

Figure 7 Capacitance vs Vds
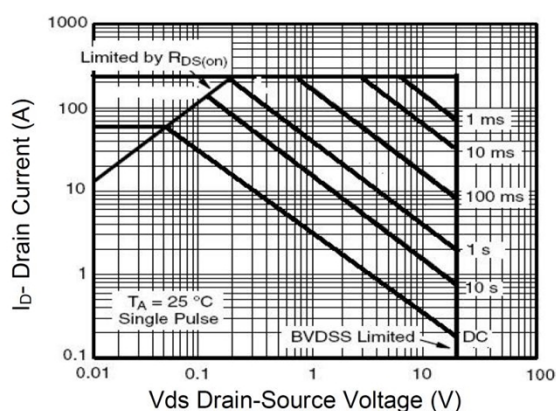

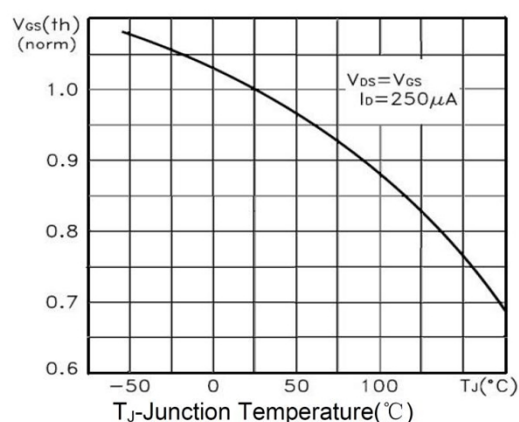**Figure 9 Power De-rating**

Figure 8 Safe Operation Area
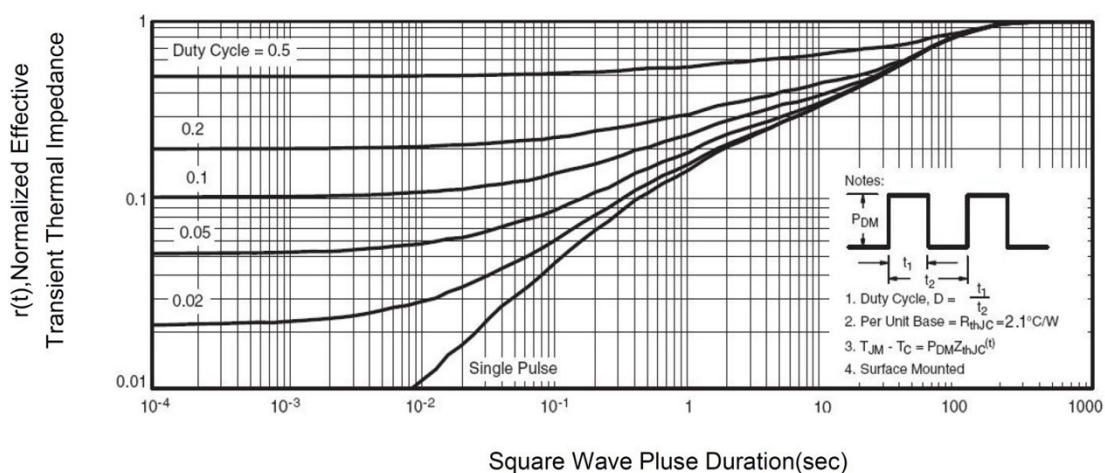

Figure 10 V$_{GS(th)}$ vs Junction Temperature

Notes:
1. Duty Cycle, $D = \dfrac{t_1}{t_2}$
2. Per Unit Base $= R_{thJC} = 2.1°C/W$
3. $T_{JM} - T_C = P_{DM}Z_{thJC}^{(t)}$
4. Surface Mounted

Square Wave Pluse Duration(sec)

Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252 Package Information

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 REF.		0.211 REF.	