

- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology
- ★ 100% EAS Guaranteed

## Product Summary

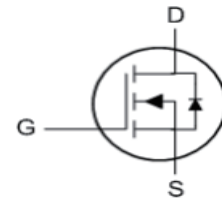
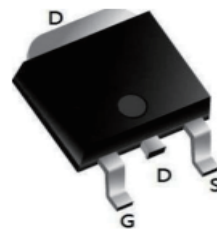
BVDSS	RDSON	ID
20V	16mΩ	20A

## Description

The 20N02 is the high cell density trenched N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The 20N02 meet the RoHS and Green Product, requirement 100% EAS guaranteed with full function reliability approved.

## TO252 Pin Configuration



## Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V <sub>DS</sub>	Drain-Source Voltage	20	V
V <sub>GS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub> @T <sub>C</sub> =25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup>	20	A
I <sub>D</sub> @T <sub>C</sub> =100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup>	12	A
I <sub>D</sub> @T <sub>A</sub> =25°C	Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup>	8.2	A
I <sub>D</sub> @T <sub>A</sub> =70°C	Continuous Drain Current, V <sub>GS</sub> @ 10V <sup>1</sup>	6.5	A
I <sub>DM</sub>	Pulsed Drain Current <sup>2</sup>	40	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	22.1	mJ
I <sub>AS</sub>	Avalanche Current	20	A
P <sub>D</sub> @T <sub>C</sub> =25°C	Total Power Dissipation <sup>4</sup>	5	W
P <sub>D</sub> @T <sub>A</sub> =25°C	Total Power Dissipation <sup>4</sup>	2	W
T <sub>STG</sub>	Storage Temperature Range	-55 to 150	°C
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150	°C

## Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJA</sub>	Thermal Resistance Junction-ambient (Steady State) <sup>1</sup>	---	62	°C/W
R <sub>θJC</sub>	Thermal Resistance Junction-Case <sup>1</sup>	---	5	°C/W

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	20	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	$BV_{DSS}$ Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$	-	0.023	-	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=4.5V, I_D=8.0A$	-	16	25	$m\Omega$
		$V_{GS}=2.5V, I_D=5.0A$	-	22	30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	0.4	0.8	1.2	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		-	-5.2	-	$mV/^\circ\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=24V, V_{GS}=0V, T_J=25^\circ\text{C}$	-	-	1	$\mu A$
		$V_{DS}=24V, V_{GS}=0V, T_J=55^\circ\text{C}$	-	-	5	nA
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS} = \pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
$g_{fs}$	Forward Transconductance <sup>Note</sup>	$V_{DS}=5V, I_D=15A$	-	21.6	-	S
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	-	2.5	5	$\Omega$
$Q_g$	Total Gate Charge (4.5V)	$V_{DS}=15V, V_{GS}=4.5V, I_D=15A$	-	6.2	8.7	nC
$Q_{gs}$	Gate-Source Charge		-	2.4	3.4	
$Q_{gd}$	Gate-Drain Charge		-	2.5	3.5	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=15V, V_{GS}=10V, R_G=3.3\Omega, I_D=15A$	-	4	6	ns
$T_r$	Rise Time		-	7.6	14	
$T_{d(off)}$	Turn-Off Delay Time		-	21	42	
$T_f$	Fall Time		-	4	8	
$C_{iss}$	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	-	472	801	pF
$C_{oss}$	Output Capacitance		-	71	113	
$C_{rss}$	Reverse Transfer Capacitance		-	55	91	

**Diode Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current <sup>1,5</sup>	$V_G=V_D=0V$ , Force Current	-	-	20	A
$I_{SM}$	Pulsed Source Current <sup>2,5</sup>		-	-	40	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F=15A, di/dt=100A/\mu s$ ,	-	17	-	nS
$Q_{rr}$	Reverse Recovery Charge	$T_J=25^\circ\text{C}$	-	3	-	nC

Note :

- The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
- The EAS data shows Max. rating. The test condition is  $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=21A$
- The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
- The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

Typical Performance Characteristics

Figure 1: Output Characteristics

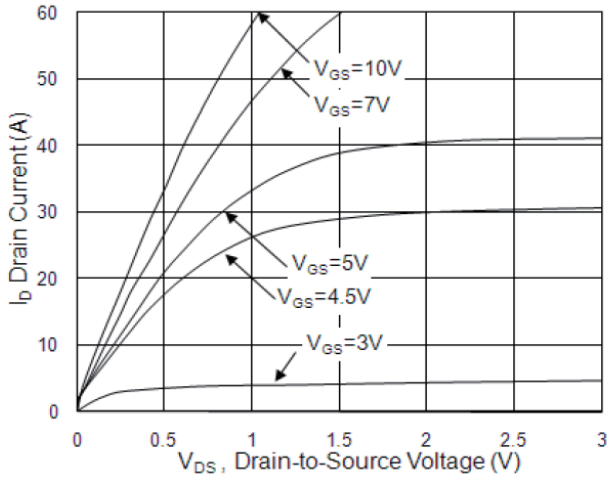


Figure 2: On-Resistance v.s Gate Source

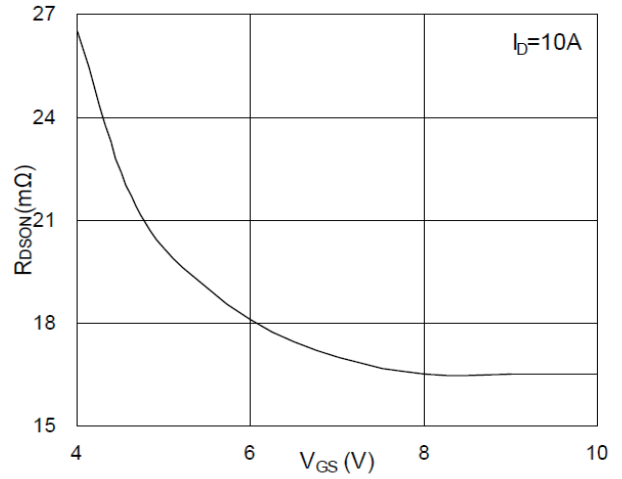


Figure 3: Forward Characteristics of  $R_{DS(on)}$

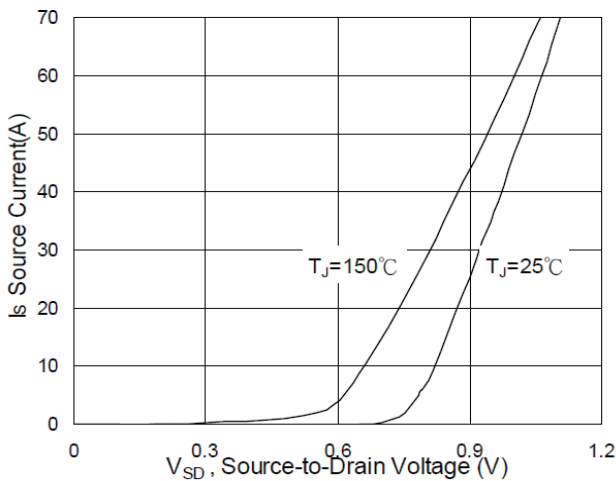


Figure 4: Gate Charge Characteristics

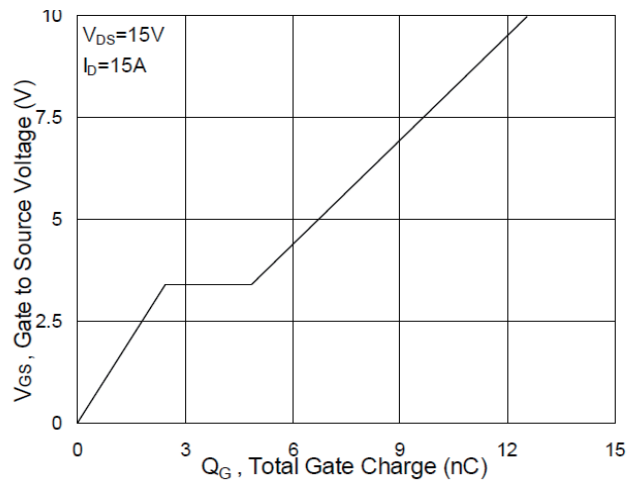


Figure 5: Normalized  $V_{GS(th)}$  v.s  $T_J$

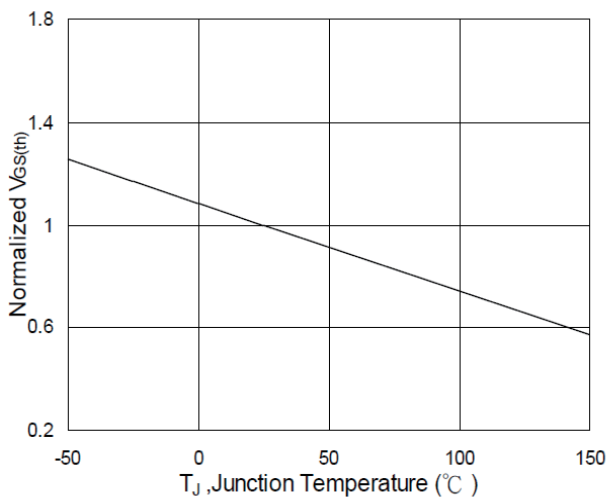
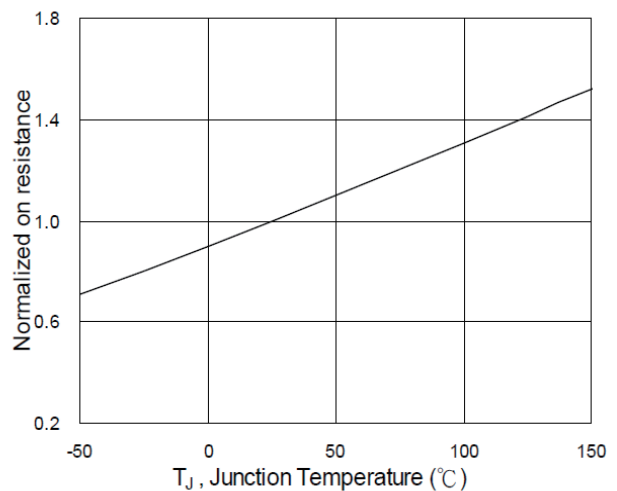


Figure 6: Normalized  $R_{DS(on)}$  v.s  $T_J$



Typical Performance Characteristics

Figure 7: Capacitance

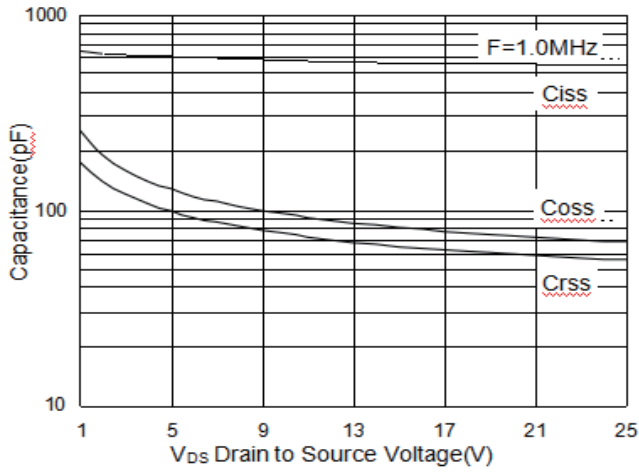


Figure 8: Safe Operating Area

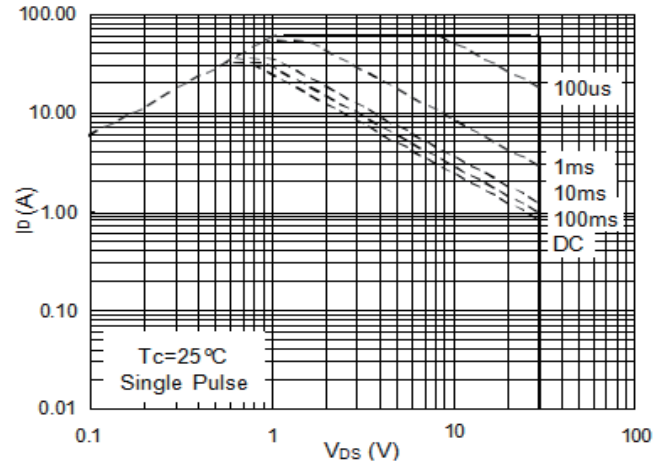


Figure 9: Normalized Maximum Transient Thermal Impedance

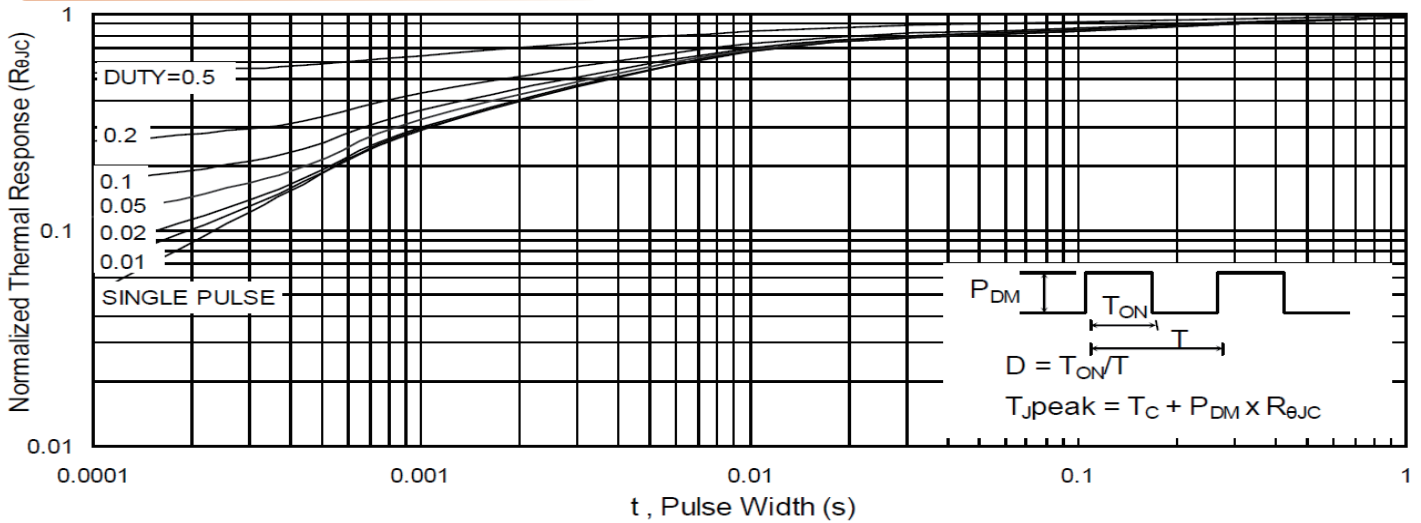


Figure 10: Switching Time Waveform

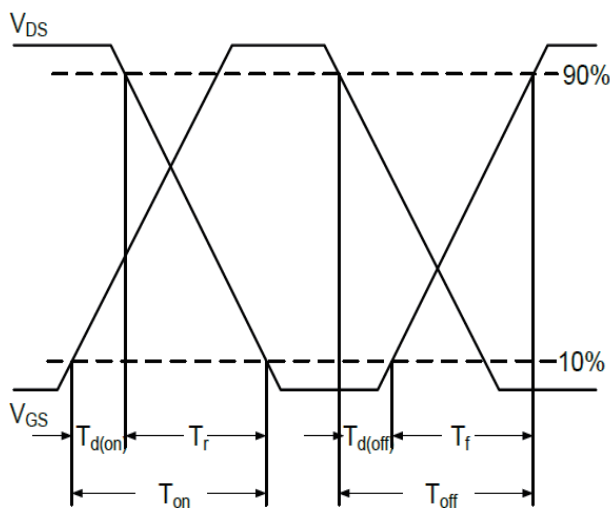
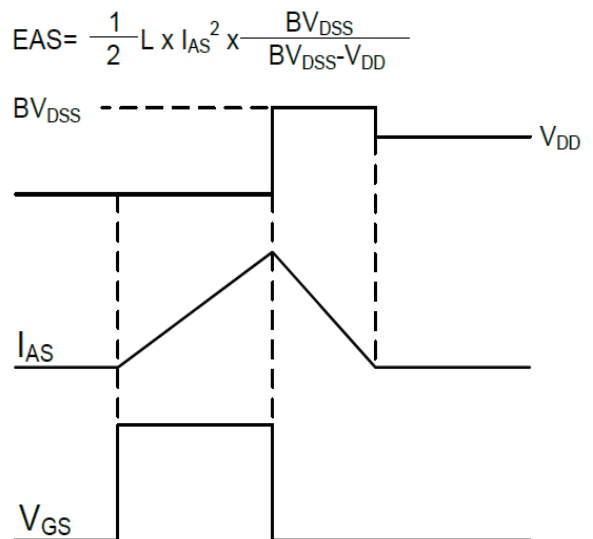
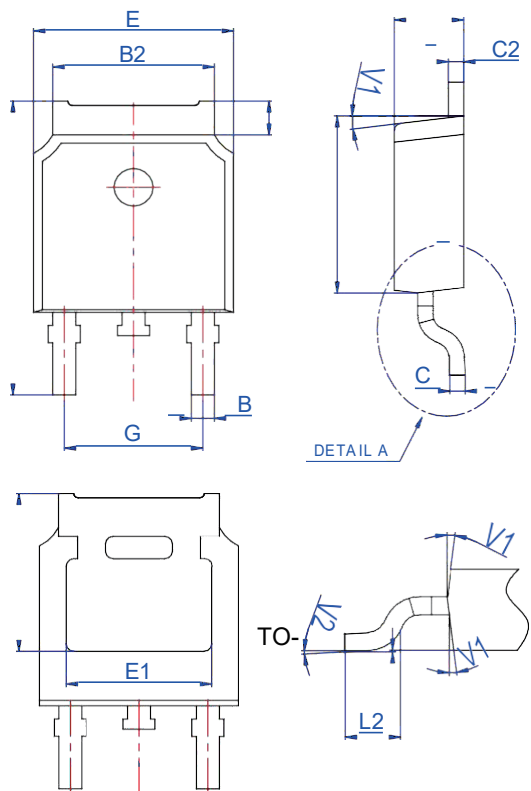


Figure 11: Unclamped Inductive Switching

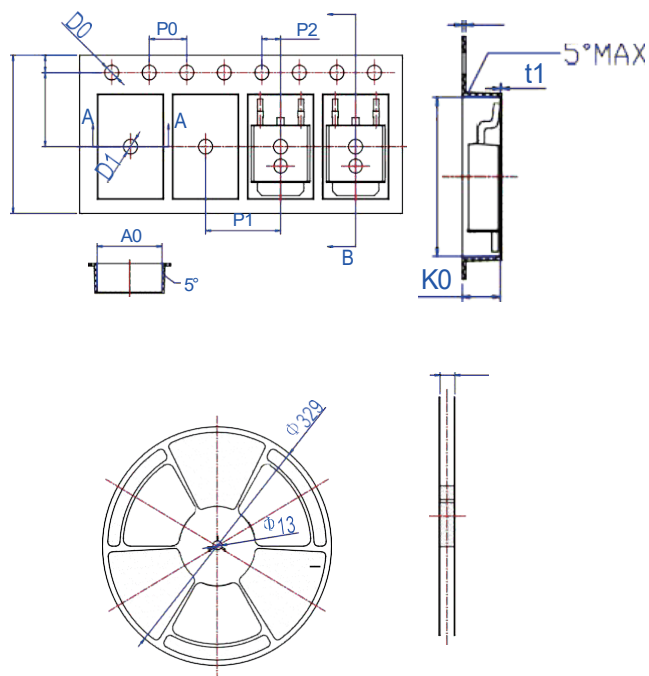


## Package Mechanical Data-TO-252-4R



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.1		2.5	0.083		0.098
A2	0		0.1	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.4		0.6	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.9		6.3	0.232		0.248
D1	5.30REF			0.209REF		
E	6.4		6.8	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.5		10.7	0.374		0.421
L	1.09		1.21	0.043		0.048
L2	1.35		1.65	0.053		0.065
V1		7°			7°	
V2	0°		6°	0°		6°

## Reel Specification-TO-252-4R



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
W	15.9	16	16.1	0.626	0.63	0.634
E	1.65	1.75	1.85	0.065	0.069	0.073
F	7.4	7.5	7.6	0.291	0.295	0.299
D0	1.4	1.5	1.6	0.055	0.059	0.063
D1	1.4	1.5	1.6	0.055	0.059	0.063
P0	3.9	4	4.1	0.154	0.157	0.161
P1	7.9	8	8.1	0.311	0.315	0.319
P2	1.9	2	2.1	0.075	0.079	0.083
A0	6.85	6.9	7	0.27	0.271	0.276
B0	10.45	10.5	10.6	0.411	0.413	0.417
K0	2.68	2.78	2.88	0.105	0.109	0.113
T	0.24		0.27	0.009		0.011
t1	0.1			0.004		
10P0	39.8	40	40.2	1.567	1.575	1.583