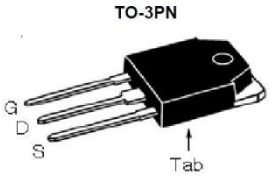
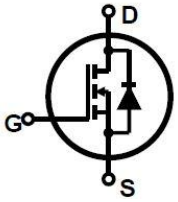
N-channel MOSFET

BV_{DSS}	I_D	$R_{DS(on)}$
600V	20A	< 0.33Ω

Features

- Low gate charge
- 100% avalanche tested
- Improved dv/dt capability
- RoHS compliant
- JEDEC Qualification





Device	Package	Marking	Remark
TMAN20N60A	TO-3PN	TMAN20N60A	RoHS

Absolute Maximum Ratings

Parameter		Symbol	TMAN20N60A	Unit
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current	T_C = 25 ℃	I_D	20	A
	T_C = 100 ℃		12.8	A
Pulsed Drain Current (Note 1)		I_{DM}	80	A
Single Pulse Avalanche Energy (Note 2)		E_{AS}	826	mJ
Repetitive Avalanche Current (Note 1)		I_{AR}	20	A
Repetitive Avalanche Energy (Note 1)		E_{AR}	34.7	mJ
Power Dissipation	T_C = 25 ℃	P_D	347	W
	Derate above 25 ℃		2.77	W/℃
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55~150	℃
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		T_L	300	℃

* Limited only by maximum junction temperature

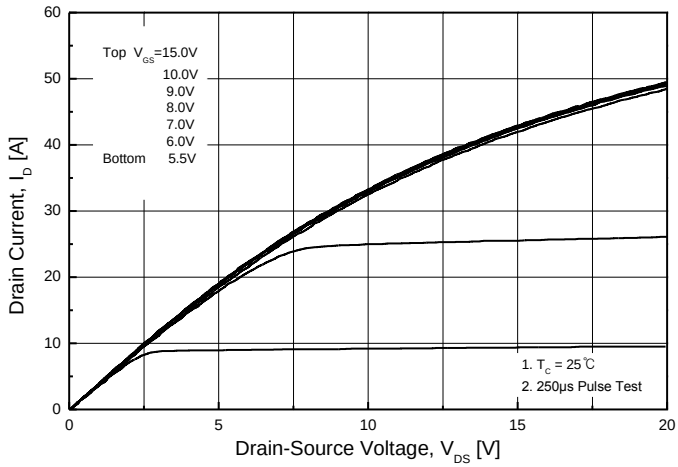
Thermal Characteristics

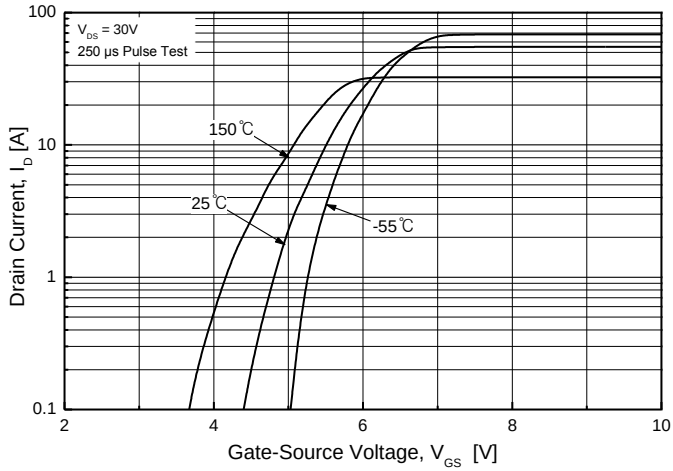
Parameter	Symbol	TMAN20N60A	Unit
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$	0.36	℃/W
Maximum Thermal resistance, Junction-to-Ambient	$R_{\theta JA}$	62.5	℃/W

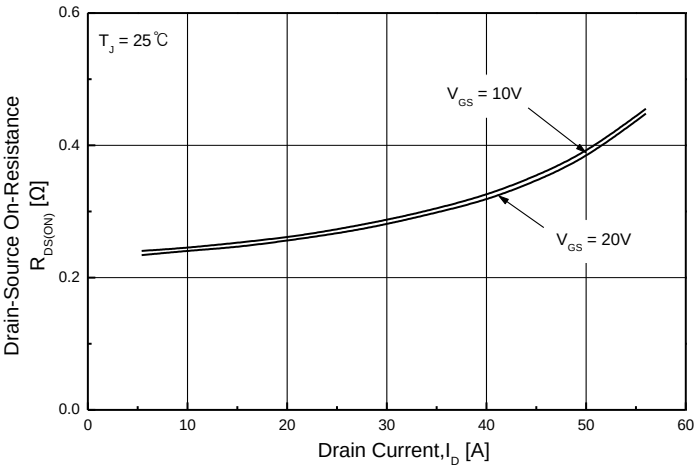
Electrical Characteristics : T_C=25℃, unless otherwise noted

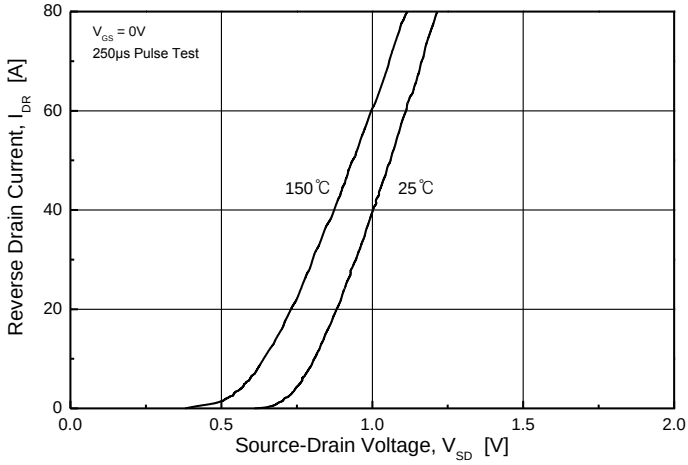
Parameter	Symbol	Test condition	Min	Typ	Max	Units
OFF						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0 V, I_D = 250 μA	600	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V	--	--	1	μA
		V_{DS} = 480 V, T_C = 125°C	--	--	10	μA
Forward Gate-Source Leakage Current	I_{GSSF}	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
Reverse Gate-Source Leakage Current	I_{GSSR}	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
ON						
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA	3	--	5	V
Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 10 A	--	0.27	0.33	Ω
Forward Transconductance (Note 4)	g_{FS}	V_{DS} = 30 V, I_D = 10 A	--	18	--	S
DYNAMIC						
Input Capacitance	C_{iss}	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	3184	--	pF
Output Capacitance	C_{oss}		--	346	--	pF
Reverse Transfer Capacitance	C_{rss}		--	21	--	pF
SWITCHING						
Turn-On Delay Time (Note 4,5)	$t_{d(on)}$	V_{DD} = 300 V, I_D = 20 A, R_G = 25 Ω	--	99	--	ns
Turn-On Rise Time (Note 4,5)	t_r		--	87	--	ns
Turn-Off Delay Time (Note 4,5)	$t_{d(off)}$		--	267	--	ns
Turn-Off Fall Time (Note 4,5)	t_f		--	57	--	ns
Total Gate Charge (Note 4,5)	Q_g	V_{DS} = 480 V, I_D = 20 A, V_{GS} = 10 V	--	70	--	nC
Gate-Source Charge (Note 4,5)	Q_{gs}		--	17	--	nC
Gate-Drain Charge (Note 4,5)	Q_{gd}		--	28	--	nC
SOURCE DRAIN DIODE						
Maximum Continuous Drain-Source Diode Forward Current	I_S	---	--	--	20	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}	---	--	--	80	A
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS} = 0 V, I_S = 20 A	--	--	1.5	V
Reverse Recovery Time (Note 4)	t_{rr}	V_{GS} = 0 V, I_S = 20 A, dI_F / dt = 100 A/μs	--	465	--	ns
Reverse Recovery Charge (Note 4)	Q_{rr}		--	6.9	--	μC

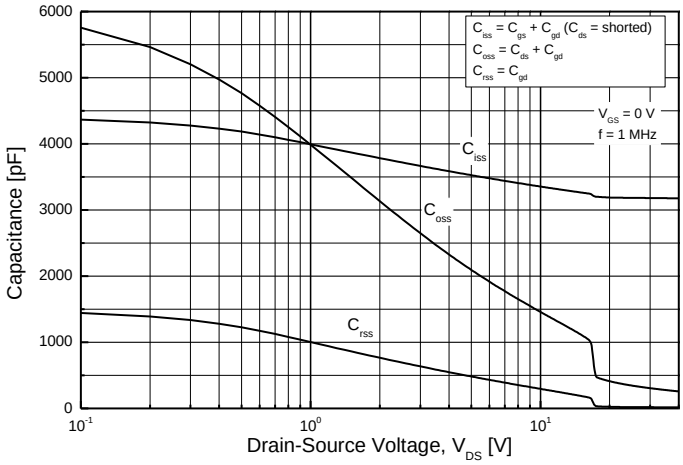
Note :
1. Repeated rating : Pulse width limited by safe operating area
2. L=3.79mH, I_{AS} = 20A, V_{DD} = 50V, R_G = 25Ω, Starting T_J= 25 ℃
3 I_{SD} ≤ 20A, di/dt ≤ 200A/μs , V_{DD} ≤ BV_{DS}, Starting T_J= 25 ℃
4. Pulse Test :Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

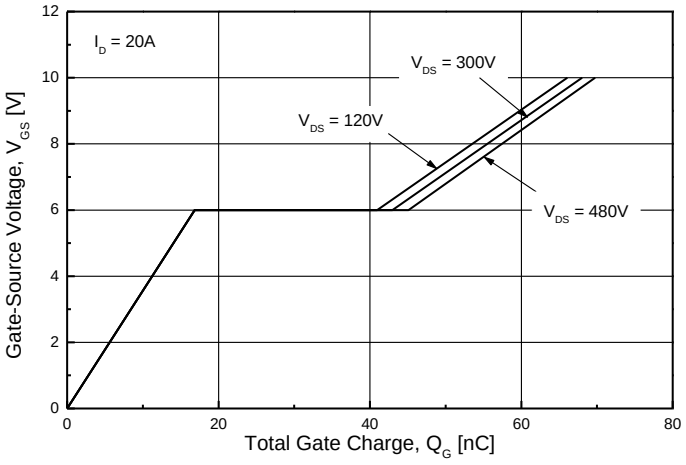

Top V_GS=15.0V
10.0V
9.0V
8.0V
7.0V
6.0V
Bottom 5.5V
1. T_C = 25℃
2. 250μs Pulse Test
Drain Current, I_D [A]
Drain-Source Voltage, V_DS [V]

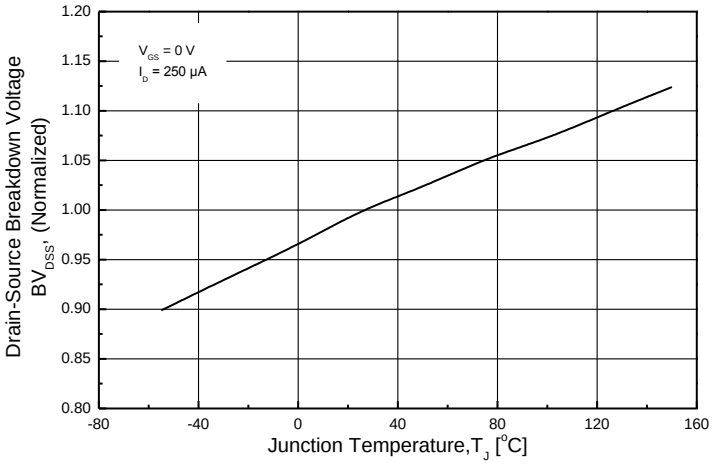

V_DS = 30V
250 μs Pulse Test
150℃
25℃
-55℃
Drain Current, I_D [A]
Gate-Source Voltage, V_GS [V]

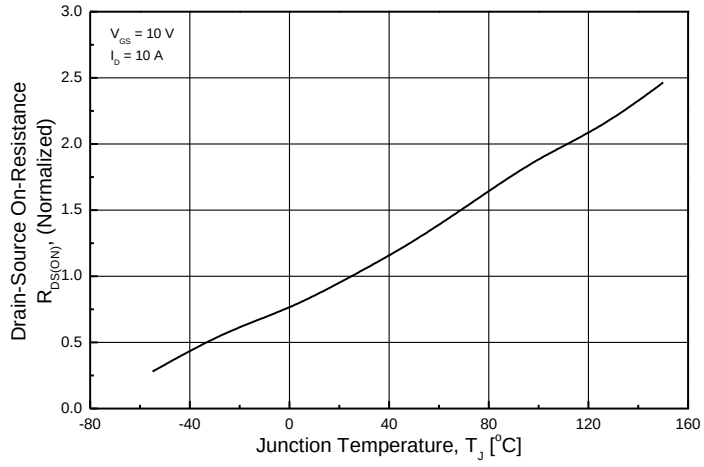

T_J = 25℃
V_GS = 10V
V_GS = 20V
Drain-Source On-Resistance
R_DS(ON) [Ω]
Drain Current,I_D [A]

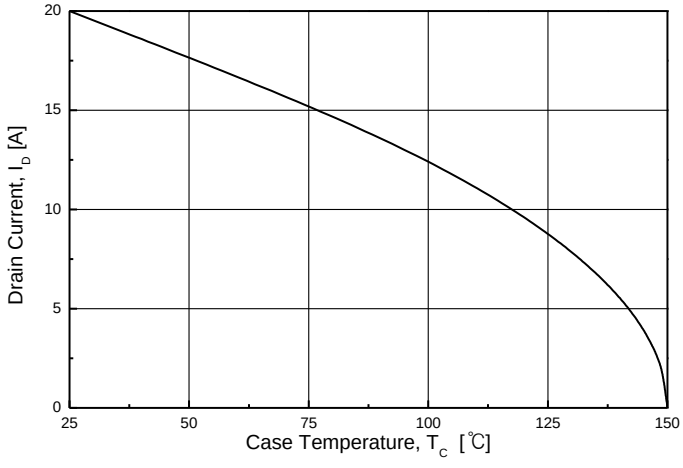

V_GS = 0V
250μs Pulse Test
150℃
25℃
Reverse Drain Current, I_DR [A]
Source-Drain Voltage, V_SD [V]

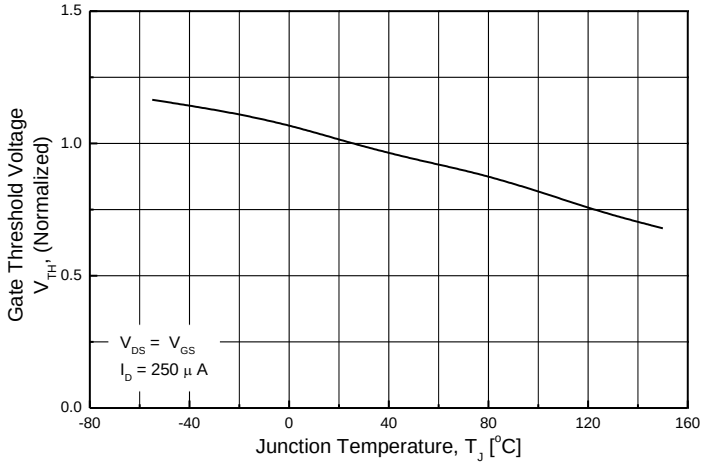

C_iss = C_gs + C_gd (C_ds = shorted)
C_oss = C_ds + C_gd
C_rss = C_gd
V_GS = 0 V
f = 1 MHz
C_iss
C_oss
C_rss
Capacitance [pF]
Drain-Source Voltage, V_DS [V]

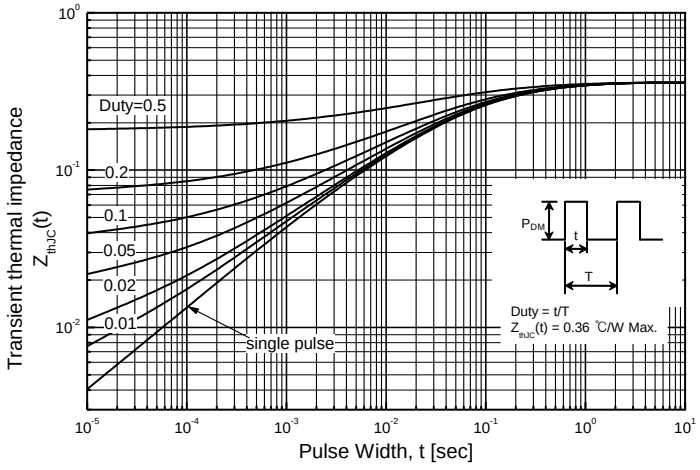

I_D = 20A
V_DS = 300V
V_DS = 120V
V_DS = 480V
Gate-Source Voltage, V_GS [V]
Total Gate Charge, Q_G [nC]

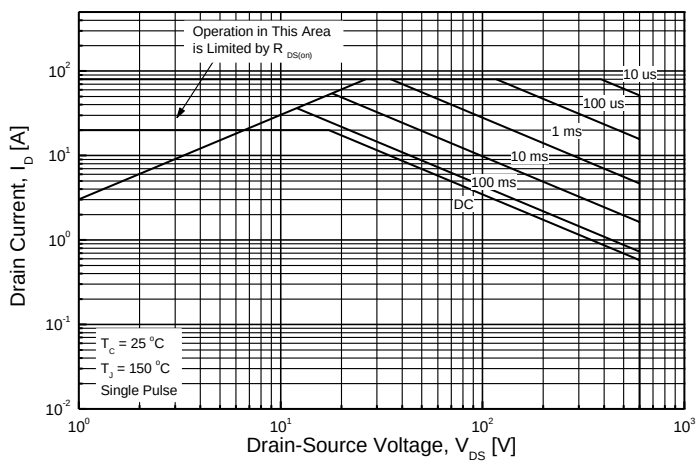

Drain-Source Breakdown Voltage
BV_DSS, (Normalized)
V_GS = 0 V
I_D = 250 μA
Junction Temperature,T_J [°C]


Drain-Source On-Resistance
R_DS(ON), (Normalized)
V_GS = 10 V
I_D = 10 A
Junction Temperature, T_J [°C]

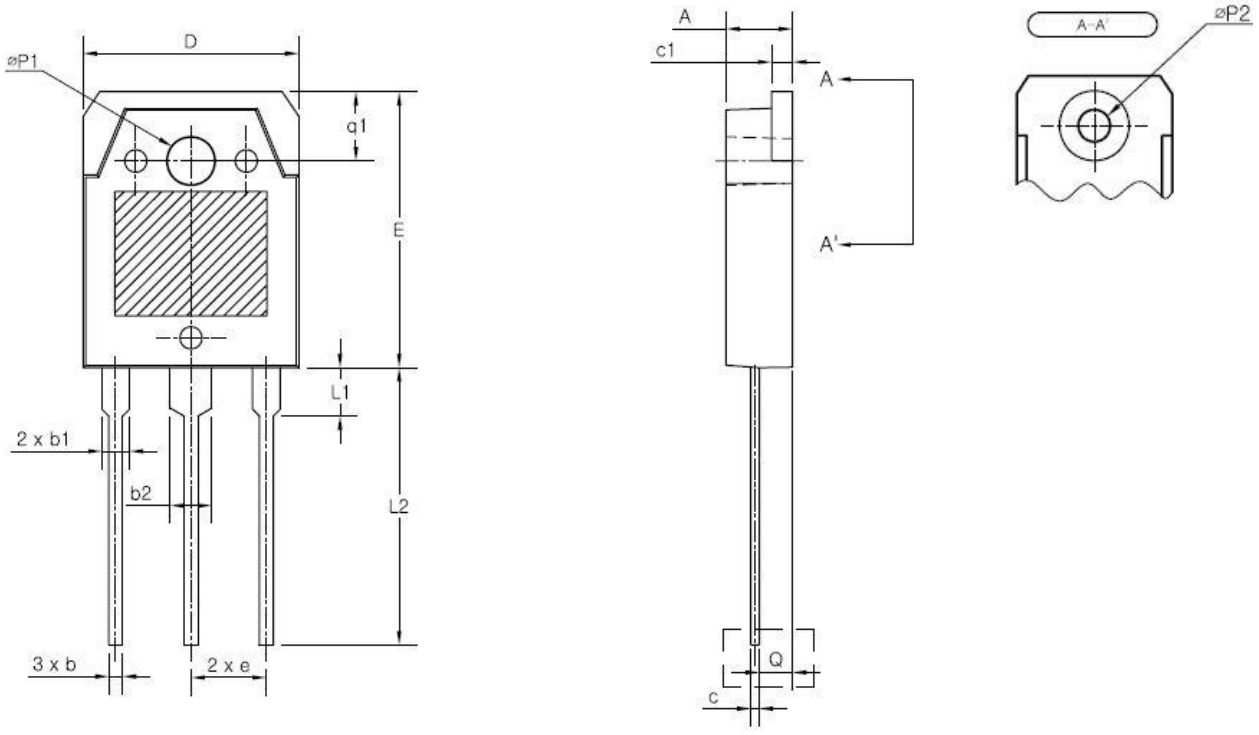

Drain Current, I_D [A]
Case Temperature, T_C [℃]


Gate Threshold Voltage
V_TH, (Normalized)
V_DS = V_GS
I_D = 250 μ A
Junction Temperature, T_J [°C]


Transient thermal impedance
Z_thJC(t)
Duty=0.5
0.2
0.1
0.05
0.02
0.01
single pulse
P_DM
t
T
Duty = t/T
Z_thJC(t) = 0.36 ℃/W Max.
Pulse Width, t [sec]


Operation in This Area
is Limited by R DS(on)
10 us
100 us
1 ms
10 ms
100 ms
DC
T_C = 25 °C
T_J = 150 °C
Single Pulse
Drain Current, I_D [A]
Drain-Source Voltage, V_DS [V]

TO-3PN MECHANICAL DATA



SYMBOL	MIN	NOM	MAX
A	4.60	4.80	5.00
b	0.80	1.00	1.20
b1	1.80	2.00	2.20
b2	2.80	3.00	3.20
c	0.55	0.60	0.75
c1	1.45	1.50	1.65
D	15.40	15.60	15.80
E	19.70	19.90	20.10
e	5.15	5.45	5.75
L1	3.30	3.50	3.70
L2	19.80	20.00	20.20
øP1	3.30	3.40	3.50
øP2		(3.20)	
Q	2.20	2.40	2.60
q1	4.80	5.00	5.20