
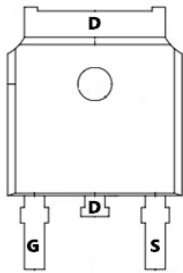


TM20P04D

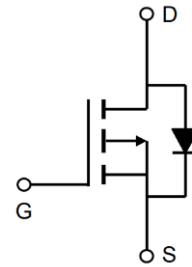
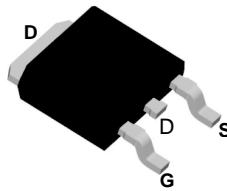
P -Channel Enhancement Mosfet

<p><b>General Description</b></p> <ul style="list-style-type: none"> <li>• Low <math>R_{DS(ON)}</math></li> <li>• RoHS and Halogen-Free Compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Load switch</li> <li>• PWM</li> </ul>	<p><b>General Features</b></p> <p><math>V_{DS} = -40V</math> <math>I_D = -20A</math></p> <p><math>R_{DS(ON)} = 36m\Omega</math>(typ.) @ <math>V_{GS} = -10V</math></p> <p>100% UIS Tested                  100% <math>R_g</math> Tested</p> 
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Marking: 20P04

D:TO-252-3L



**Absolute Maximum Ratings** ( $T_A = 25^\circ C$  Unless Otherwise Noted)

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain-Source Voltage	-40	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current- $T_C=25^\circ C$	-20	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	-80	A
$P_D$	Total Power Dissipation	34	W
$E_{AS}$	Single Pulsed Avalanche Energy <sup>2</sup>	40.6	mJ
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +175	$^\circ C$

**Thermal Characteristics:**

Symbol	Parameter	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3.67	$^\circ C/W$

TM20P04D

P -Channel Enhancement Mosfet

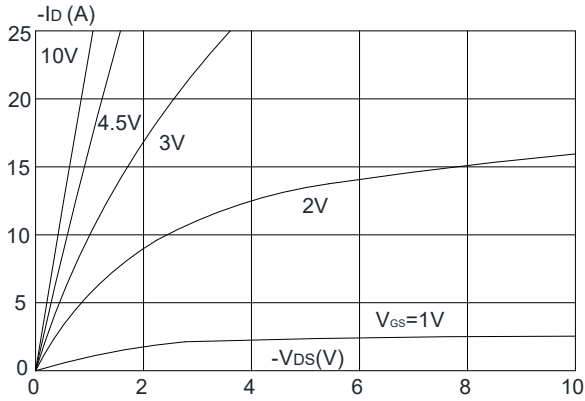
Electrical Characteristics: (T<sub>C</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250 μ A	-40	---	---	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>GS</sub> =0V, V <sub>DS</sub> =-40V	---	---	-1	μ A
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0A	---	---	±100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	GATE-Source Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250 μ A	-1	-1.6	-2.5	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance <sup>3</sup>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-8A	---	36	50	m Ω
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A	---	49	60	
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, f=1MHz	---	1033	---	pF
C <sub>oss</sub>	Output Capacitance		---	106	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	79	---	
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =-20V, I <sub>D</sub> =-5A, V <sub>GS</sub> =-10V, R <sub>G</sub> =2.5 Ω	---	7	---	ns
t <sub>r</sub>	Rise Time		---	14	---	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		---	22	---	ns
t <sub>f</sub>	Fall Time		---	8	---	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-20V, I <sub>D</sub> =-5A	---	19	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	3.4	---	nC
Q <sub>gd</sub>	Gate-Drain "Miller" Charge		---	4.1	---	nC
<b>Drain-Source Diode Characteristics</b>						
V <sub>SD</sub>	Drain Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =-10A	---	-0.8	-1.2	V
I <sub>S</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V	---	---	-20	A
I <sub>sm</sub>	Pulsed Drain Current	V <sub>G</sub> =V <sub>D</sub> =0V	---	---	-80	A
Q <sub>rr</sub>	Reverse Recovery Charge	V <sub>GS</sub> =0V, I <sub>S</sub> =-5A,	---	20	---	nC
t <sub>rr</sub>	Reverse Recovery Time	di/dt=100A/μs	---	29	---	ns

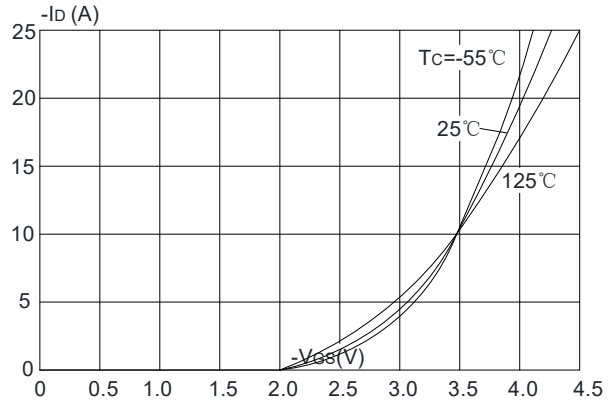
**Notes:**

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. EAS condition: T<sub>J</sub>= 25 °C, V<sub>DD</sub>= -20V, V<sub>G</sub>= -10V, L=0.5mH, R<sub>G</sub>= 25Ω, I<sub>AS</sub>= -10.5A
3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤2%

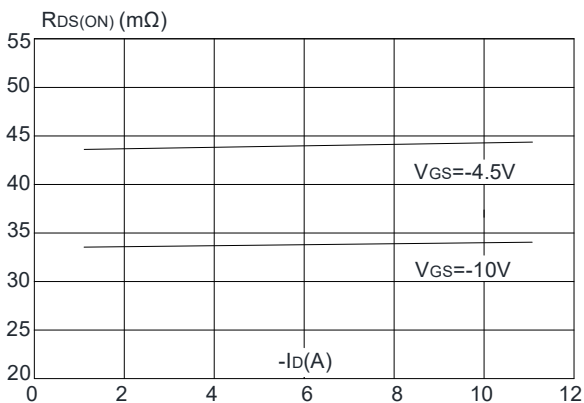
**Typical Characteristics**



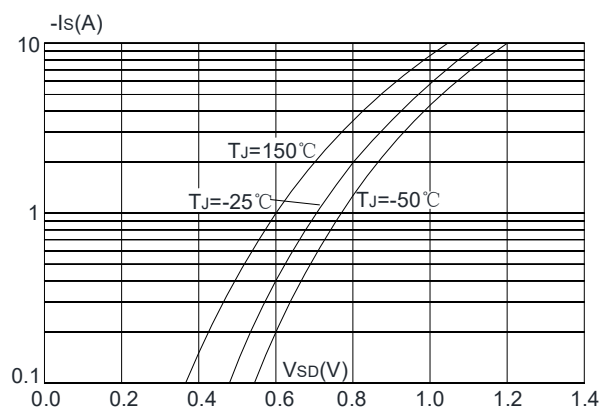
**Figure 1:** Output Characteristics



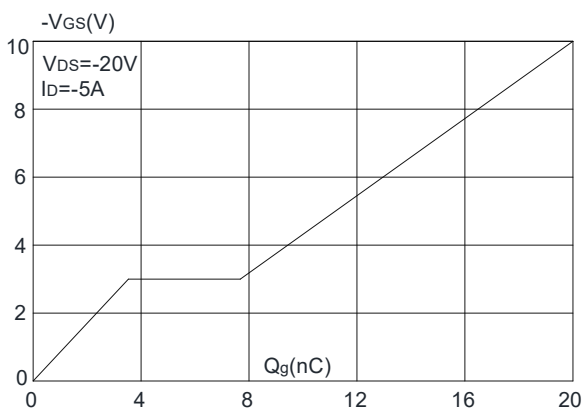
**Figure 2:** Typical Transfer Characteristics



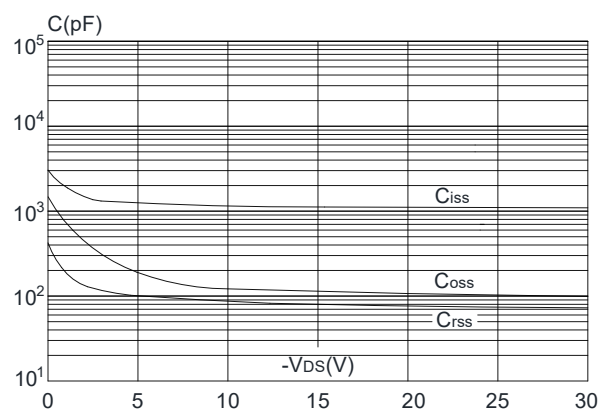
**Figure 3:** On-resistance vs. Drain Current



**Figure 4:** Body Diode Characteristics



**Figure 5:** Gate Charge Characteristics



**Figure 6:** Capacitance Characteristics

TM20P04D

P-Channel Enhancement Mosfet

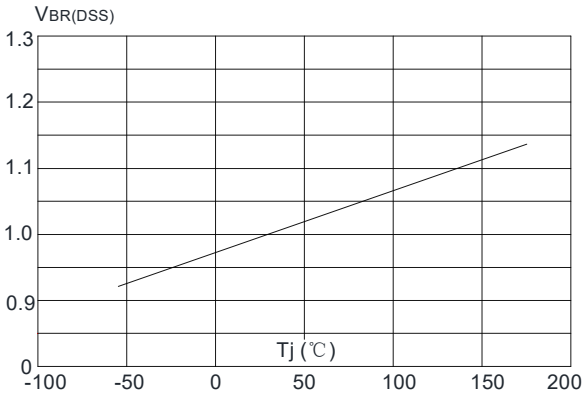


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

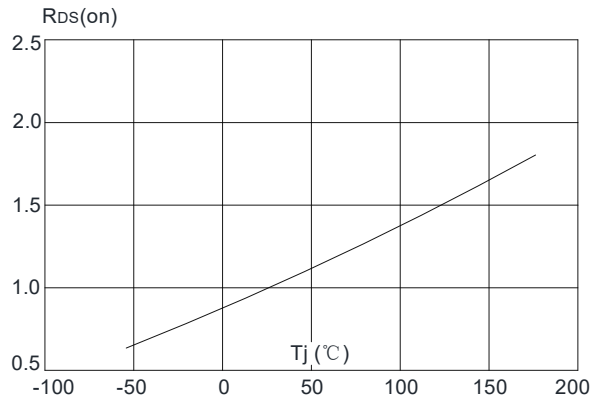


Figure 8: Normalized on Resistance vs. Junction Temperature

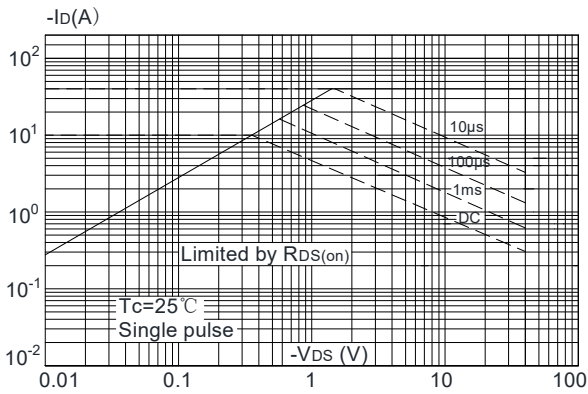


Figure 9: Maximum Safe Operating Area

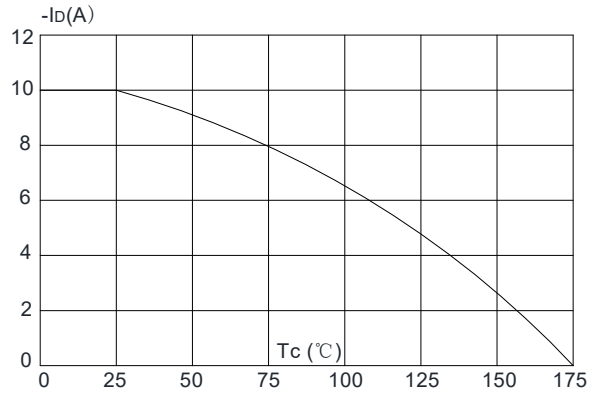


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

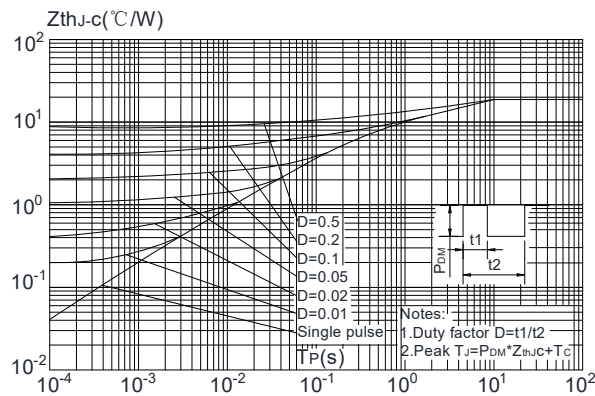
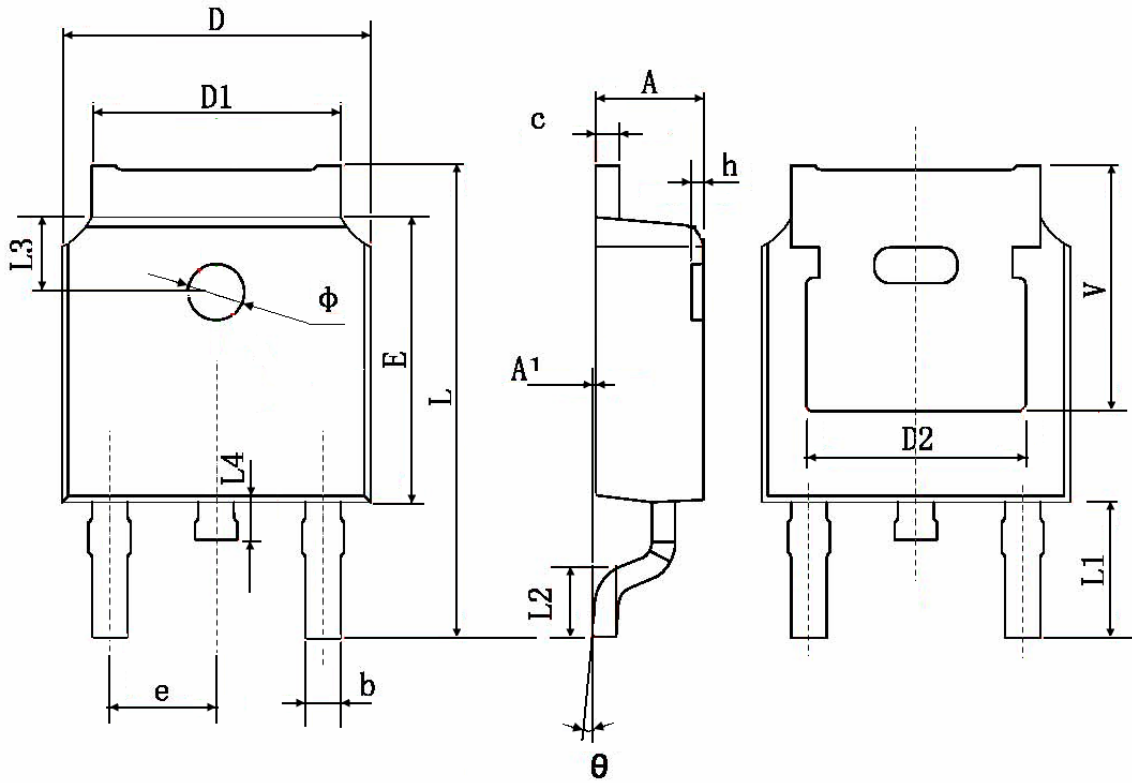


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

## Package Information:TO-252-3L



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 TYP.		0.190 TYP.	
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 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
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 TYP.		0.211 TYP.	