

9978GP-VB Datasheet N-Channel 60-V (D-S) MOSFET

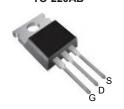
PRODUCT SUMMARY					
V _{DS} (V)	$R_{DS(on)}(\Omega)$	I _D (A) ^a			
60	0.011 at V _{GS} = 10 V	60			
	0.013 at V _{GS} = 4.5 V	50			

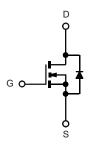
FEATURES

- 175 °C Junction Temperature
- Trench Power MOSFET
- Material categorization:









N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)						
Parameter		Symbol	Limit	Unit		
Gate-Source Voltage		V _{GS}	± 20	V		
Continuous Prain Current /T = 175 °C\h	T _C = 25 °C	- I _D	60			
Continuous Drain Current (T _J = 175 °C) ^b	T _C = 100 °C	טי	50ª			
Pulsed Drain Current	I _{DM}	200	Α			
Continuous Source Current (Diode Conduction)	I _S	50ª				
Avalanche Current	I _{AS}	50				
Single Avalanche Energy (Duty Cycle ≤ 1 %)	L = 0.1 mH	E _{AS}	125	mJ		
Maximum Power Dissipation	T _C = 25 °C	P _D	136	W		
Maximum Fower Dissipation	T _A = 25 °C] 'D [3 ^b , 8.3 ^{b, c}			
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to 175	°C		

THERMAL RESISTANCE RATINGS							
Parameter		Symbol	Typical	Maximum	Unit		
Mariana III da Ambianta	t ≤ 10 sec	R _{thJA}	15	18	°C/W		
Maximum Junction-to-Ambient ^a	Steady State	† ¹\thJA	40	50			
Maximum Junction-to-Case		R _{thJC}	0.85	1.1			

Notes:

- a. Package limited.
- b. Surface mounted on 1" x 1" FR4 board.
- $c.\ t \leq 10\ s.$



Parameter	Symbol	Test Conditions	Min.	Typ.a	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V _{DS}	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	60			V	
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA			3		
Gate-Body Leakage	I _{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 100	nA	
		V _{DS} = 60 V, V _{GS} = 0 V	, 90		1	μA	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 60 V, V _{GS} = 0 V, T _J = 125 °C			50		
		V _{DS} = 60 V, V _{GS} = 0 V, T _J = 175 °C			250	1	
On-State Drain Current ^b	I _{D(on)}	V _{DS} = 5 V, V _{GS} = 10 V	60			Α	
		V _{GS} = 10 V, I _D = 20 A		0.011			
	D	V _{GS} = 10 V, I _D = 20 A, T _J = 125 °C		0.014		0	
Drain-Source On-State Resistance ^b	R _{DS(on)}	V _{GS} = 10 V, I _D = 20 A, T _J = 175 °C	0.018			Ω	
		V _{GS} = 4.5 V, I _D = 15 A		0.013			
Forward Transconductance ^b	9 _{fs}	V _{DS} = 15 V, I _D = 20 A		60		S	
Dynamic							
Input Capacitance	C _{iss}			4200			
Output Capacitance	C _{oss}	$V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$		570		pF	
Reverse Transfer Capacitance	C _{rss}			325			
Total Gate Charge ^c	Qg			47			
Gate-Source Charge ^c	Q _{gs}	$V_{DS} = 30 \text{ V}, V_{GS} = 10 \text{ V}, I_{D} = 50 \text{ A}$		10		nC	
Gate-Drain Charge ^c	Q_{gd}			12			
Turn-On Delay Time ^c	t _{d(on)}			10	20		
Rise Time ^c	t _r	$V_{DD} = 30 \text{ V}, R_{L} = 0.6 \Omega$		15	25	no	
Turn-Off Delay Time ^c	t _{d(off)}	$I_D \cong 50 \text{ A}, V_{GEN} = 10 \text{ V}, R_g = 2.5 \Omega$		35	50	ns	
Fall Time ^c	t _f			20	30		
Source-Drain Diode Ratings and Cha	aracteristics (T _C = 25 °C)					
Pulsed Current	I _{SM}				60	Α	
Diode Forward Voltage	V _{SD}	I _F = 20 A, V _{GS} = 0 V		1	1.5	V	
Reverse Recovery Time	t _{rr}	I _F = 20 A, di/dt = 100 A/μs		45	100	ns	

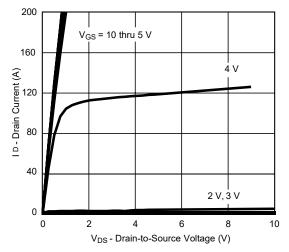
Notes:

- a. For design aid only; not subject to production testing.
- b. Pulse test; pulse width \leq 300 μ s, duty cycle \leq 2 %.
- c. Independent of operating temperature.

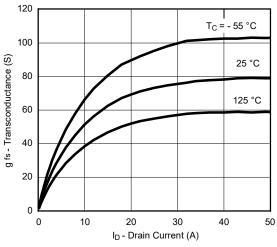
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



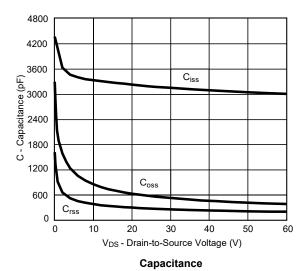
TYPICAL CHARACTERISTICS (25 °C unless noted)



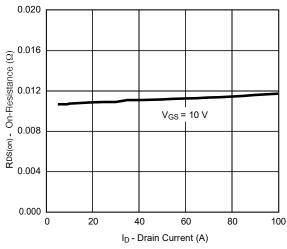
Output Characteristics



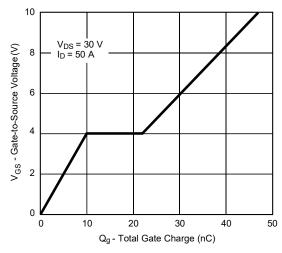
Transconductance



V_{GS} - Gate-to-Source Voltage (V) **Transfer Characteristics**



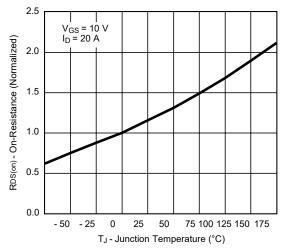
On-Resistance vs. Drain Current



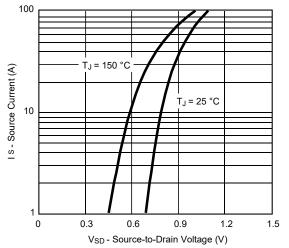
Gate Charge



TYPICAL CHARACTERISTICS (25 °C unless noted)



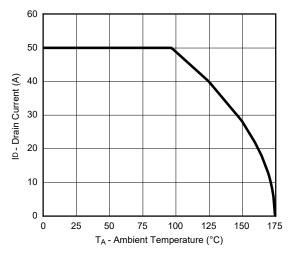
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage



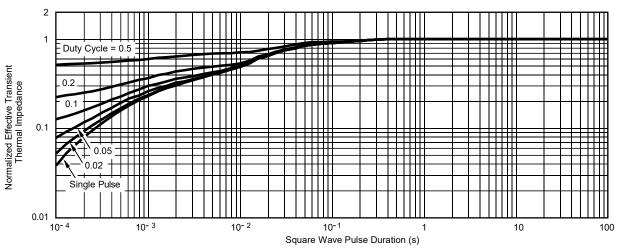
THERMAL RATINGS



1000 Limited by R_{DS(on)*} 100 100 µs ID - Drain Current (A) 10 1 ms 10 ms 100 ms DC T_C = 25 °C Single Pulse 0.1 0.01 0.1 10 100 V_{DS} - Drain-to-Source Voltage (V) V_{GS} > minimum V_{GS} at which R_{DS(on)} is specified

Safe Operating Area

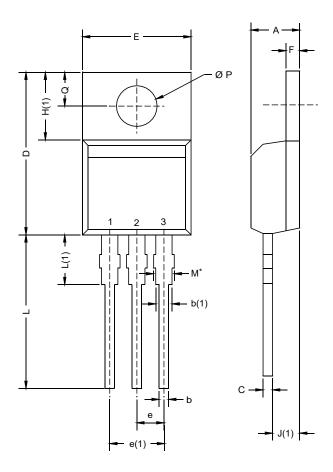
Maximum Drain Current vs. Ambient Temperature



Normalized Thermal Transient Impedance, Junction-to-Case



TO-220AB



DIM.	MILLIM	ETERS	INCHES			
	MIN.	MAX.	MIN.	MAX.		
А	4.24	4.65	0.167	0.183		
b	0.69	1.02	0.027	0.040		
b(1)	1.14	1.78	0.045	0.070		
С	0.36	0.61	0.014	0.024		
D	14.33	15.85	0.564	0.624		
Е	9.96	10.52	0.392	0.414		
е	2.41	2.67	0.095	0.105		
e(1)	4.88	5.28	0.192	0.208		
F	1.14	1.40	0.045	0.055		
H(1)	6.10	6.71	0.240	0.264		
J(1)	2.41	2.92	0.095	0.115		
L	13.36	14.40	0.526	0.567		
L(1)	3.33	4.04	0.131	0.159		
ØР	3.53	3.94	0.139	0.155		
Q	2.54	3.00	0.100	0.118		
ECN: X15-0364-Rev. C, 14-Dec-15 DWG: 6031						

Note

• M* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM



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