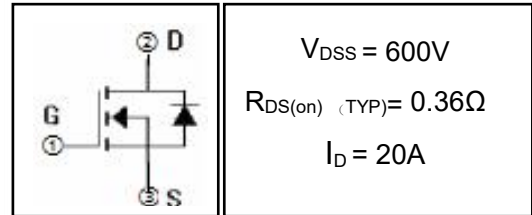


20A 600V N-channel Enhancement Mode Power MOSFET

1 Description

These silicon N-channel Enhanced VDMOSFETs are obtained by the self-aligned planar Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The package form is TO-220F. Which accords with the RoHS standard.

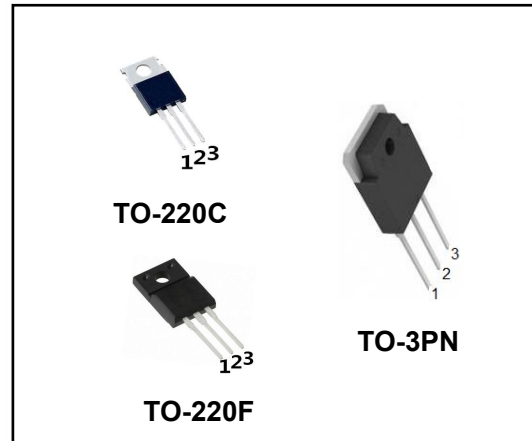


2 Features

- Fast Switching
- Low On Resistance ($R_{DS(on)} \leq 0.45\Omega$)
- Low Gate Charge (Typical: 61nC)
- Low Reverse Transfer Capacitances (Typical: 20pF)
- 100% Single Pulse Avalanche Energy Test
- 100% ΔV_{DS} Test

3 Application

- Used in various power switching circuit for system miniaturization and higher efficiency.
- Power switch circuit of adaptor and charger.



4 Electrical Characteristics

4.1 Absolute Maximum Rating ($T_C = 25^\circ\text{C}$, unless otherwise noted)

PARAMETER		SYMBOL	VALUE			UNIT
			20N60	F20N60	20N60D	
Maximum Drain-Source DC Voltage		V_{DS}	600			V
Maximum Gate-Drain Voltage		V_{GS}	± 30			V
Drain Current (continuous)		$I_D (T = 25^\circ\text{C})$ $(T = 100^\circ\text{C})$	20			A
			14			A
Drain Current (Pulsed) (Note 1)		I_{DM}	80			A
Single Pulse Avalanche Energy (Note 5)		E_{AS}	1200			mJ
Peak Diode Recovery dv/dt (Note 6)		dv/dt	5			V/ns
Total Dissipation	$T_a = 25^\circ\text{C}$	P_{tot}	2	2	3	W
	$T_C = 25^\circ\text{C}$	P_{tot}	250	85	250	W
Junction Temperature		T_j	150			$^\circ\text{C}$
storage Temperature		T_{stg}	$-55 \sim 150$			$^\circ\text{C}$
High Temperature (tin solder)		T_L	300			$^\circ\text{C}$

4.2 Thermal Characteristics

PARAMETER		SYMBOL	VALUE			UNIT
			20N60	F20N60	20N60D	
Thermal Resistance Junction to Case-sink		R_{thJC}	0.5	1.47	0.5	$^\circ\text{C/W}$
Thermal Resistance Junction to Ambient		R_{thJA}	62.5	62.5	41.7	$^\circ\text{C/W}$

4.3 Electrical Characteristics (T_c=25°C, unless otherwise noted)

PARAMETER	SYMBOL	Test Condition	VALUE			UNIT
			MIN	TYP	MAX	
Off Characteristics						
Drain-source Breakdown Voltage	BV _{DSS}	I _D =250μA, V _{GS} =0V	600	--	--	V
Drain-to-Source Leakage Current	I _{DSS}	V _{DS} =600V, V _{GS} =0V, T _C =25℃	--	--	1	μA
		V _{DS} =480V, V _{GS} =0V, T _C =125℃	--	--	100	μA
Gate-to-Source Forward Leakage	I _{GSSF}	V _{GS} =+30V	--	--	100	nA
Gate-to-Source Reverse Leakage	I _{GSSR}	V _{GS} =-30V	--	--	-100	nA
On Characteristics ^(Note 3)						
Gate threshold voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	2.0	--	4.0	V
Drain-source on Resistance ^(Note 1)	R _{DS(on)}	V _{GS} =10V, I _D =10A	--	0.36	0.45	Ω
Dynamic Characteristics ^(Note 4)						
Forward Transconductance	g _{fs}	V _{DS} =15V, I _D =10A	--	17	--	S
Input Capacitance	C _{iss}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz	--	2847	--	pF
Output Capacitance	C _{oss}		--	252	--	
Reverse Transfer Capacitance	C _{rss}		--	20	--	
Switching Characteristics ^(note4)						
Turn-on Delay Time	t _{d(on)}	I _D =20A, V _{DD} =300V, R _G =25Ω	--	36	--	nS
Turn-on Rise Time	t _r		--	73	--	nS
Turn-off Delay Time	t _{d(off)}		--	166	--	nS
Turn-off Fall Time	t _f		--	73	--	nS
Total Gate Charge	Q _g	I _D =20A, V _{DD} =300V, V _{GS} =10V	--	61	--	nC
Gate-to-Source Charge	Q _{gs}		--	14	--	
Gate-to-Drain(“Miller”)Charge	Q _{gd}		--	24	--	
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V _{FSD}	V _{GS} =0V, I _S =20A	--	--	1.5	V
Diode Forward Current ^(Note 2)	I _S		--	--	20	A
Reverse Recovery Time	t _{rr}	T _J =25℃, I _F =20A, dI _F /dt=100A/μS, V _{GS} =0V	--	425	--	nS
Reverse Recovery Charge	Q _{rr}		--	3700	--	nC

Notes:

- 1: Repetitive rating, pulse width limited by maximum junction temperature.
- 2: Surface mounted on FR4 Board, t_s≤10sec.
- 3: Pulse width ≤ 300μs, duty cycle ≤ 2%.
- 4: Guaranteed by design, not subject to production.
- 5: L=10mH, I_D=15.5A, V_{DD}=50V, V_{GATE}=600V, Start T_J=25°C.
6. I_{SD}=20A, di_F/dt≤200A/μs, V_{DD}≤BV_{DSS}, Start T_J=25°C.

5 Typical characteristics diagrams

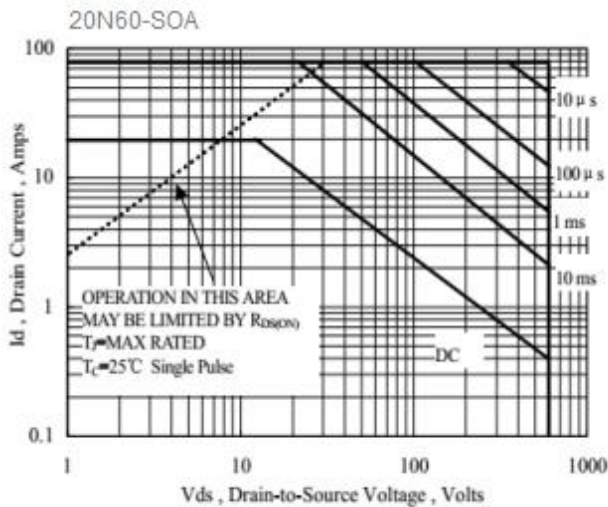


Figure 1 Maximum Forward Bias Safe Operating Area

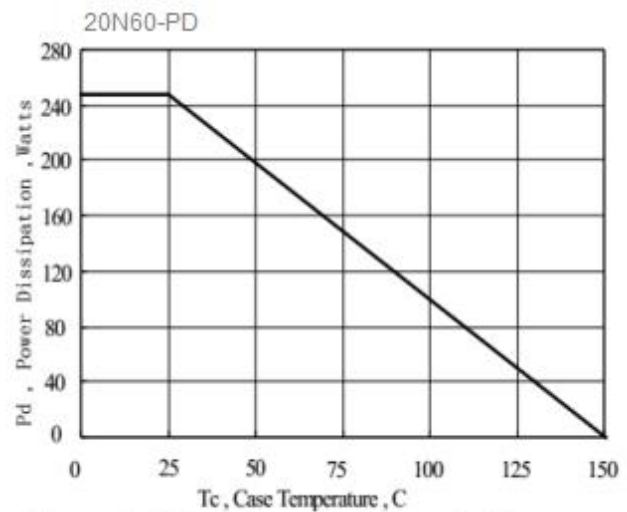


Figure 2 Maximum Power Dissipation vs Case Temperature

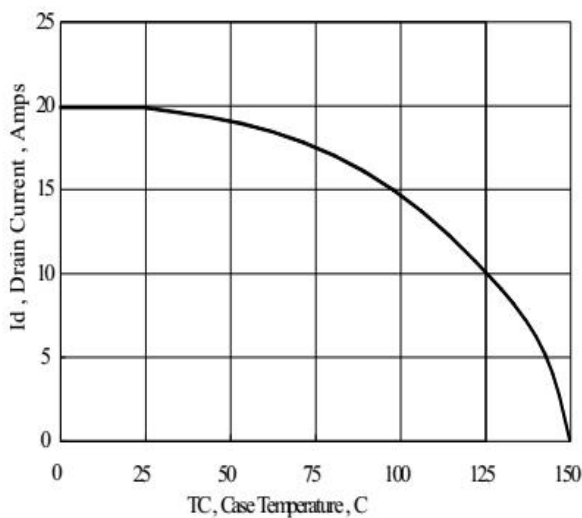


Figure 3 Maximum Continuous Drain Current vs Case Temperature

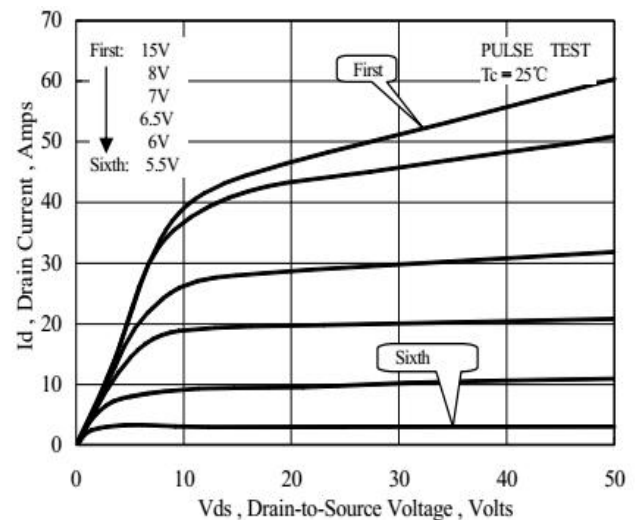


Figure 4 Typical Output Characteristics

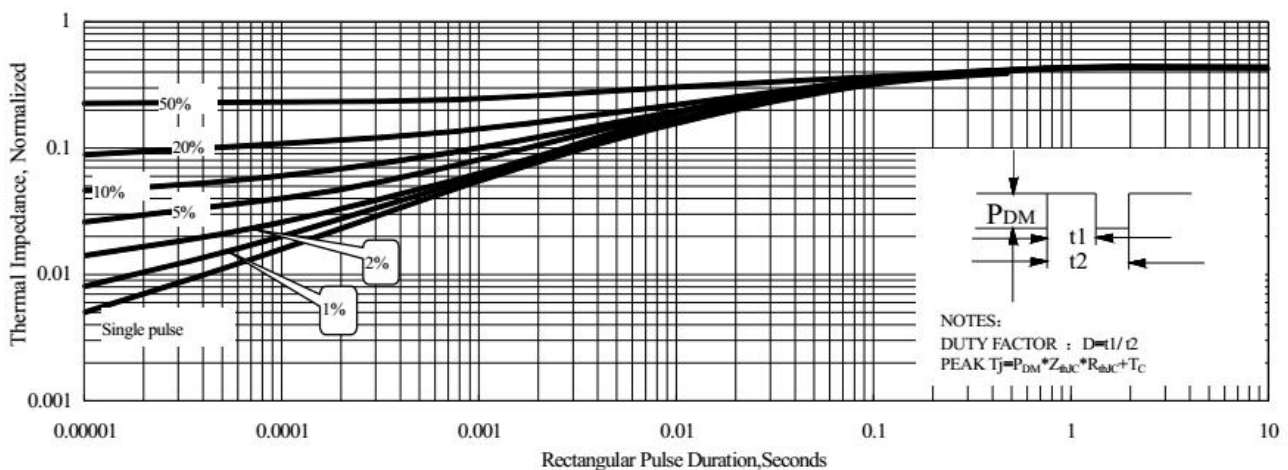


Figure 5 Maximum Effective Thermal Impedance, Junction to Case

5 Typical characteristics diagrams(continues)

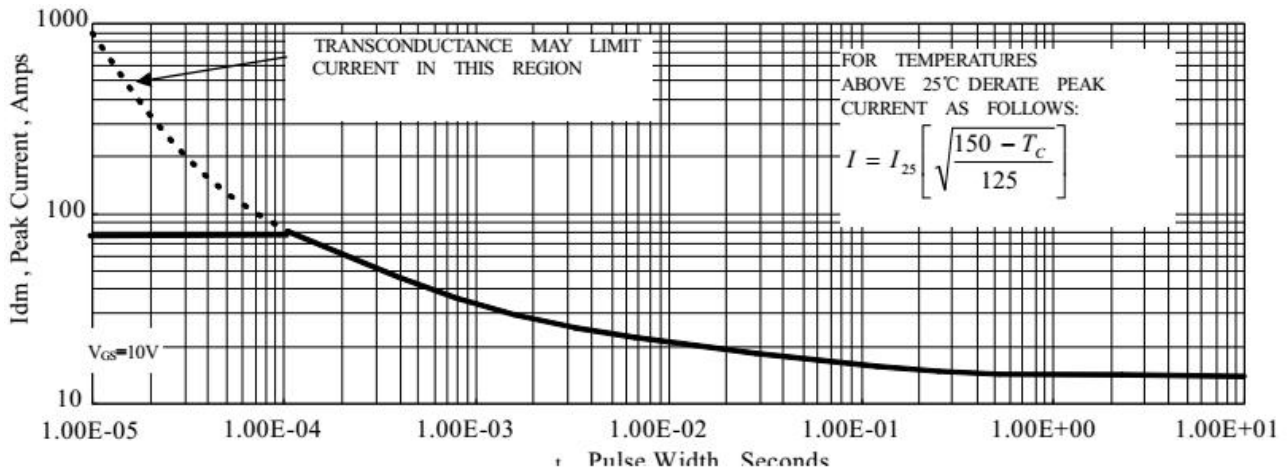


Figure 6 Maximum Peak Current Capability

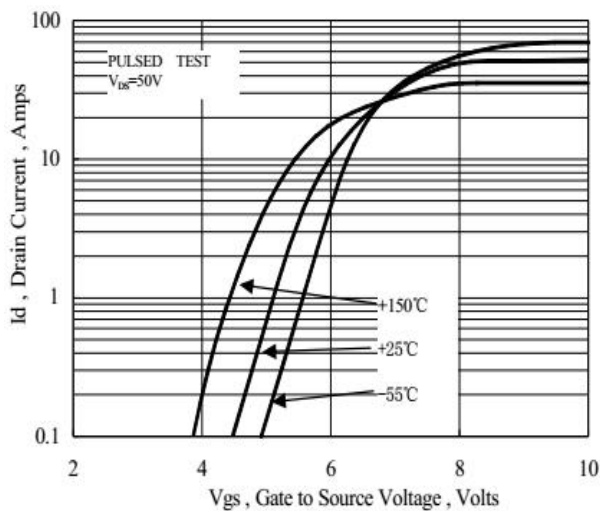


Figure 7 Typical Transfer Characteristics

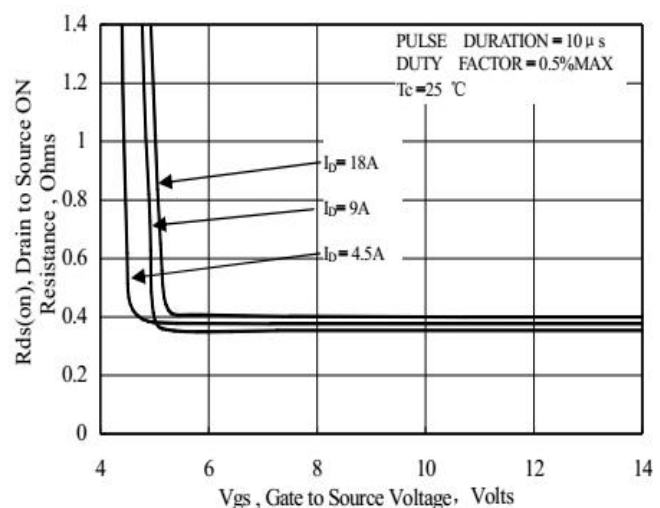


Figure 8 Typical Drain to Source ON Resistance vs Gate Voltage and Drain Current

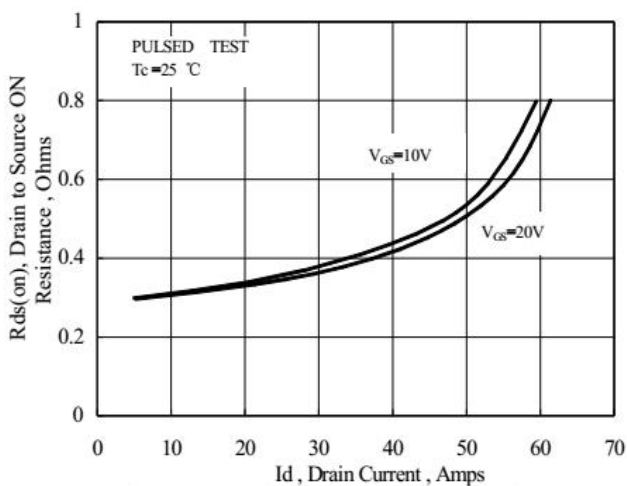


Figure 9 Typical Drain to Source ON Resistance vs Drain Current

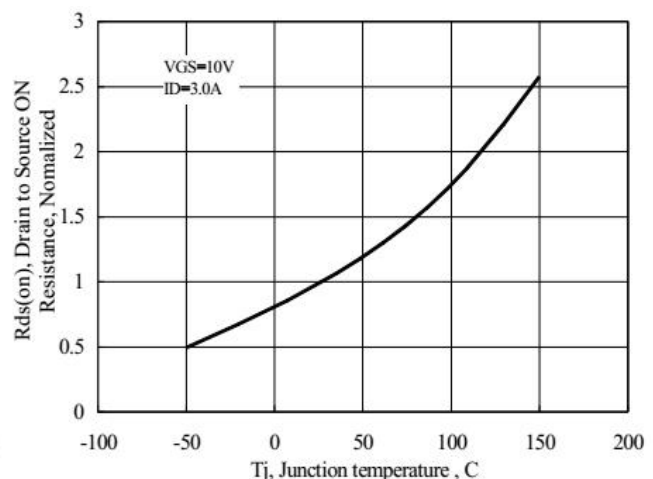


Figure 10 Typical Drain to Source on Resistance vs Junction Temperature

5 Typical characteristics diagrams(continues)

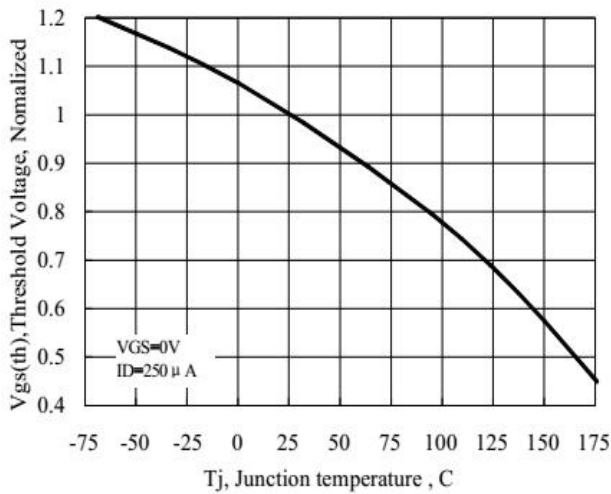


Figure 11 Typical Theshold Voltage vs Junction Temperature

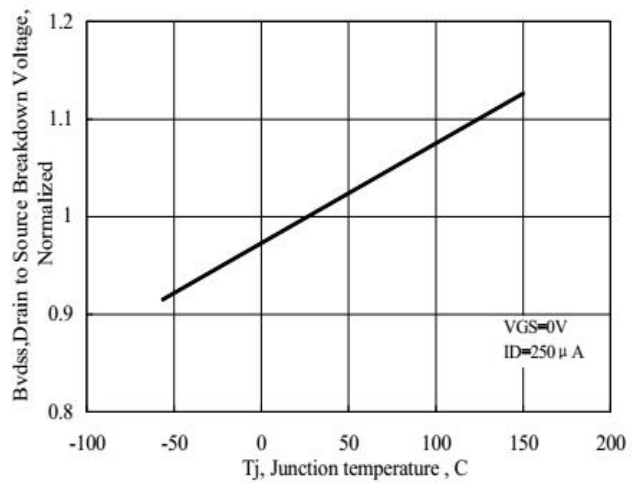


Figure 12 Typical Breakdown Voltage vs Junction Temperature

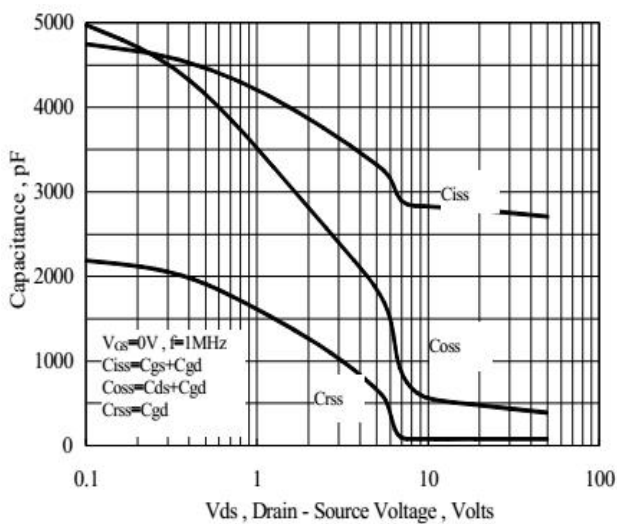


Figure 13 Typical Capacitance vs Drain to Source Voltage

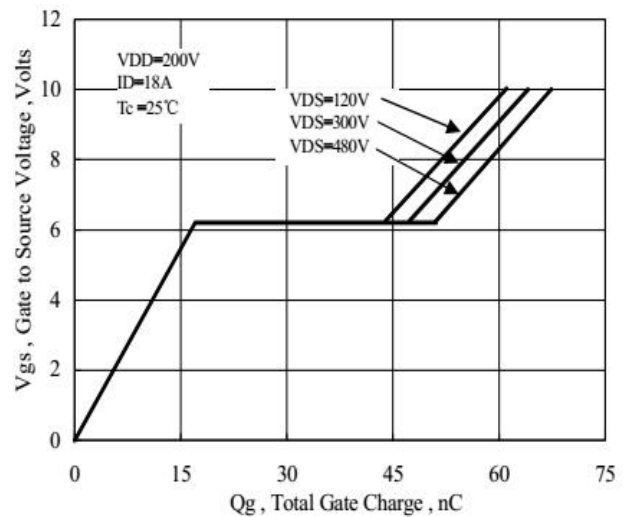


Figure 14 Typical Gate Charge vs Gate to Source Voltage

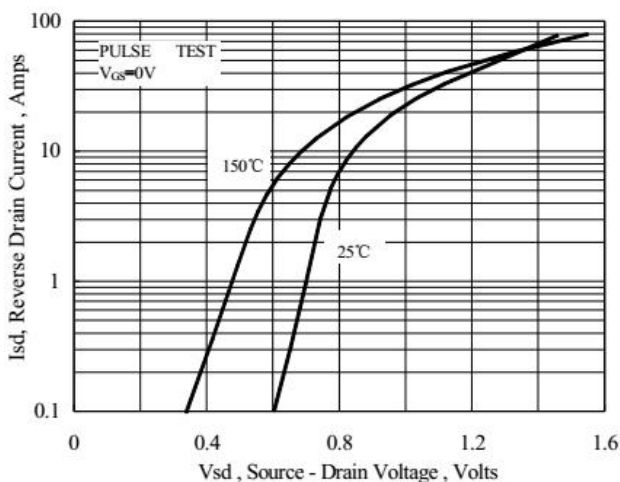


Figure 15 Typical Body Diode Transfer Characteristics

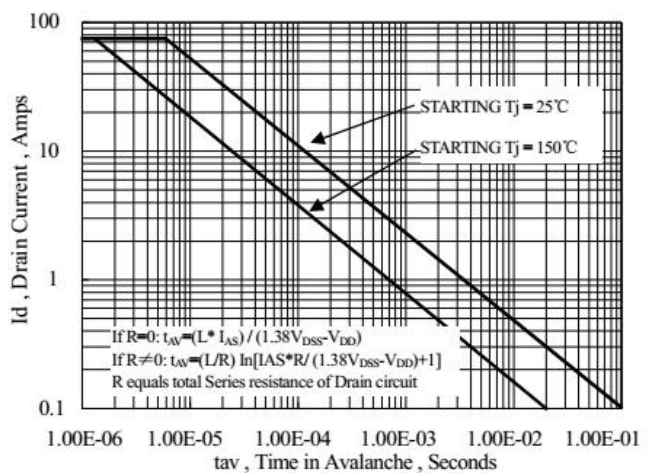


Figure 16 Unclamped Inductive Switching Capability

5 Typical characteristics diagrams(continues)

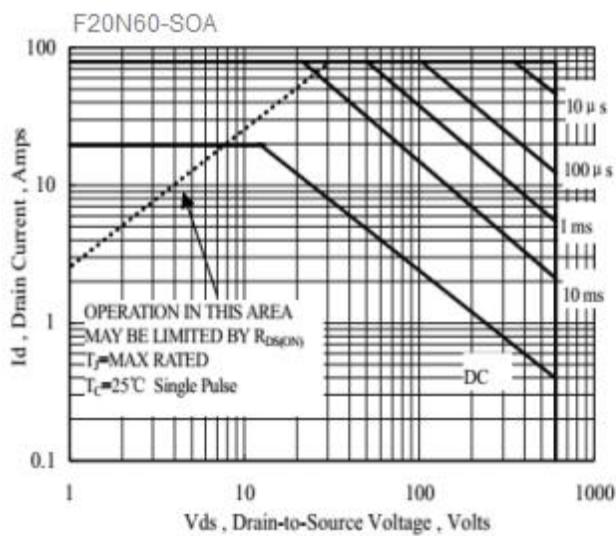


Figure 17 Maximum Forward Bias Safe Operating Area

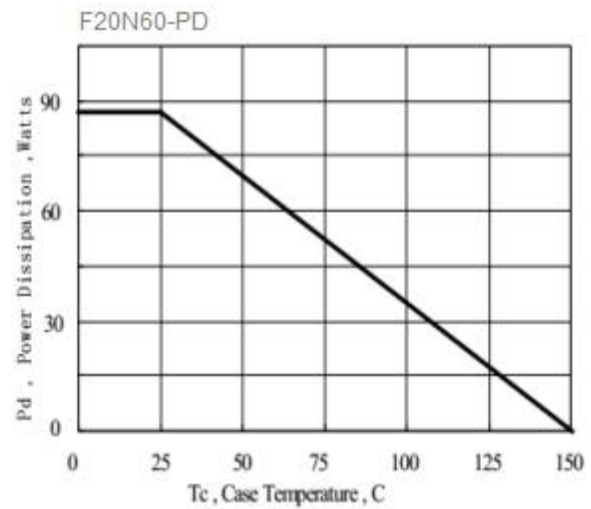


Figure 18 Maximum Power Dissipation vs Case Temperature

6 Typical Test Circuit and Waveform

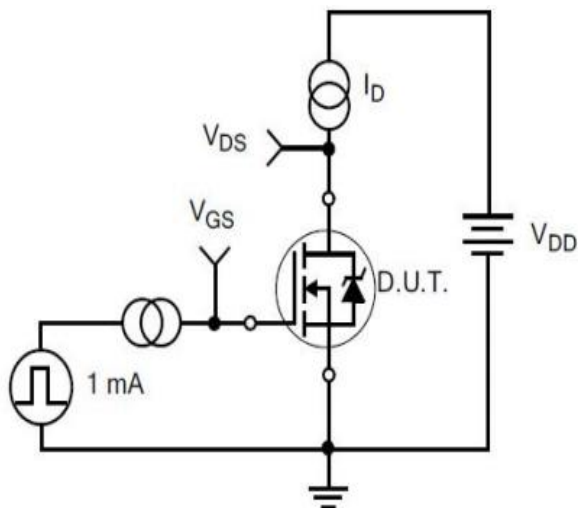


Figure 17. Gate Charge Test Circuit

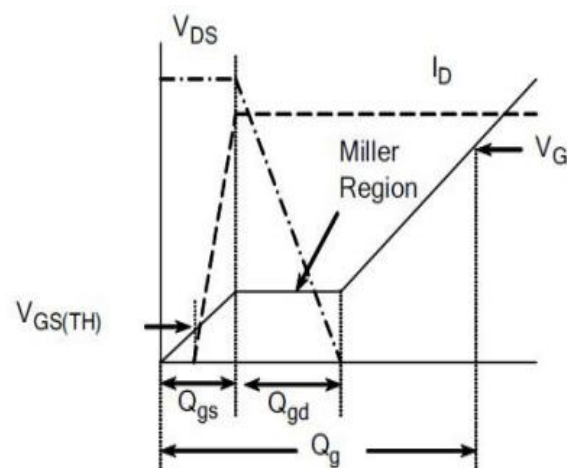


Figure 18. Gate Charge Waveform

6 Typical Test Circuit and Waveform(continues)

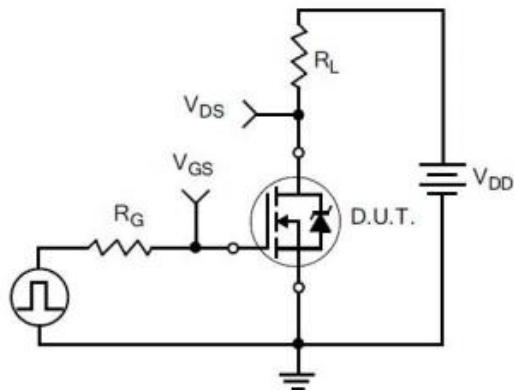


Figure 19. Resistive Switching Test Circuit

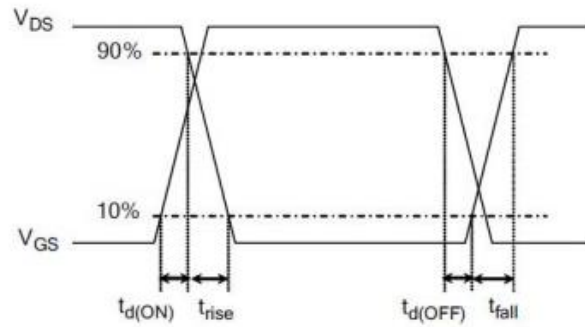


Figure 20. Resistive Switching Waveforms

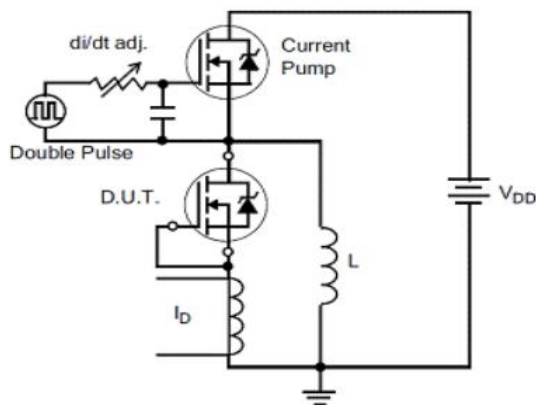


Figure 21. Diode Reverse Recovery Test Circuit

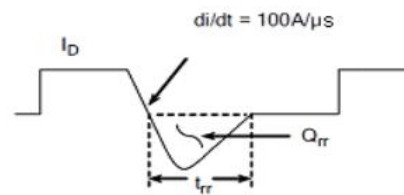


Figure 22. Diode Reverse Recovery Waveform

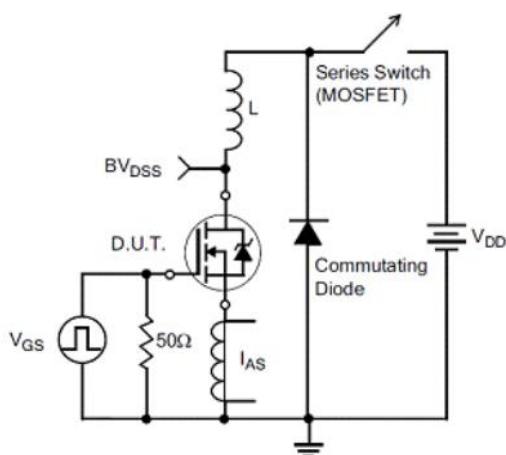


Figure 23. Unclamped Inductive Switching Test Circuit

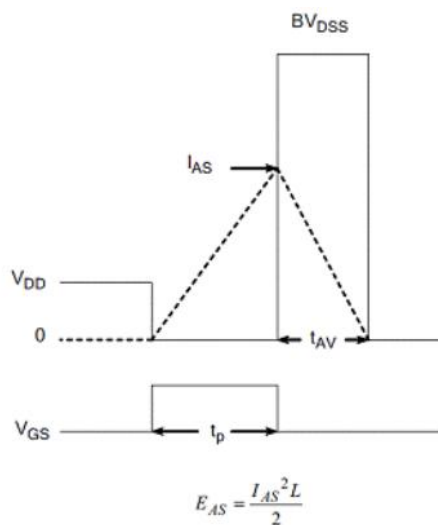


Figure 24. Unclamped Inductive Switching Waveforms

7 Product Names Rules

F X X N E X X

Packaging Code
220F: F 220: Nothing
3PN: D

Rated Voltage Code
With 2 Digital, For Example:
60 on behalf of 600V,
06 on behalf of 60v

Rated Current Code
With 1-2 Digital,
For Example:
4 on behalf of 4A,
10 on behalf of 10A,
08 on behalf of 0.8A

Special Function Code
E on behalf of build-in ESD
Nothing on behalf of not ESD

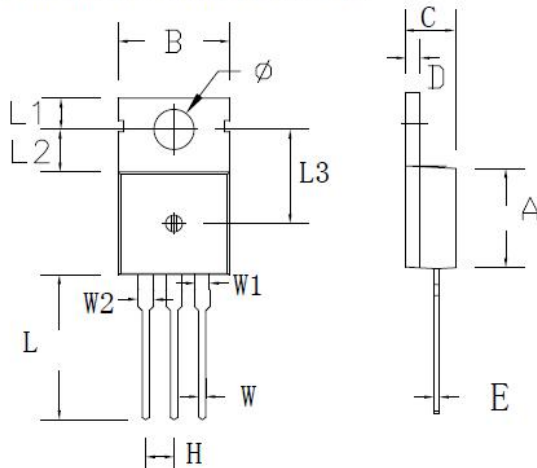
Channel Polarity Code
N on behalf of N channel
P on behalf of P channel

8 Product Specifications and Packaging Models

Product Model	Package Type	Mark Name	RoHS	Package	Quantity
20N60	TO-220C	20N60	Pb-free	Tube	1000/box
F20N60	TO-220F	F20N50	Pb-free	Tube	1000/box
20N60D	TO-3PN	20N60D	Pb-free	Tube	600/box

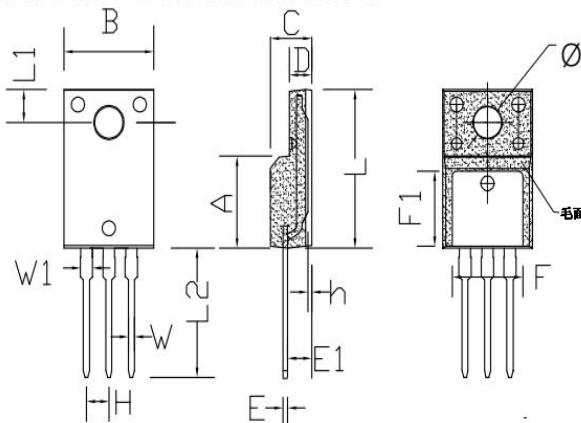
9 Dimensions

TO-220C PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	8.80	9.30	0.346	0.366
B	10.00	10.50	0.394	0.413
C	4.30	4.90	0.169	0.193
D	2.30	2.70	0.091	0.106
L	15.55	16.15	0.612	0.636
h	0.40	0.60	0.016	0.024
L1	3.15	3.55	0.124	0.140
L2	12.65	13.35	0.498	0.526
W	0.70	0.90	0.028	0.035
W1	1.15	1.55	0.045	0.061
H	2.54 TYP		0.100 TYP	
E	0.48	0.53	0.019	0.021
φ	2.90	3.40	0.114	0.134
E1	2.40	2.90	0.094	0.114
F	7.75	8.25	0.305	0.325
F1	7.35	7.85	0.289	0.309

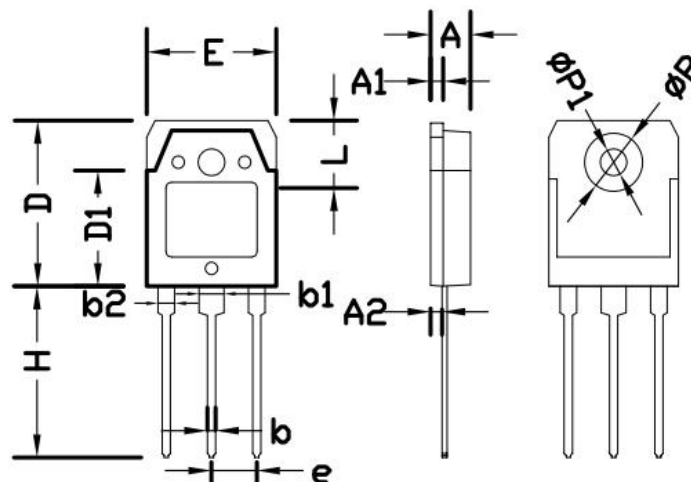
TO-220F PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	8.80	9.30	0.346	0.366
B	9.70	10.30	0.382	0.406
C	4.25	4.75	0.167	0.187
D	1.20	1.45	0.047	0.057
E	0.40	0.60	0.016	0.024
H	2.54 TYP		0.100 TYP	
W	0.60	0.95	0.024	0.037
W1	1.05	1.45	0.041	0.057
W2	1.20	1.60	0.047	0.063
L	12.60	13.40	0.496	0.528
L1	2.45	2.95	0.096	0.116
L2	3.45	3.95	0.136	0.156
L3	8.15	8.65	0.321	0.341
φ	3.50	3.90	0.138	0.154

9 Dimensions(continues)

TO-3PN PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	min.	max.	min.	max.
A	4.60	5.00	0.181	0.197
A1	1.40	1.60	0.055	0.063
A2	1.33	1.43	0.052	0.056
b	0.80	1.00	0.032	0.039
b1	2.80	3.20	0.1103	0.1261
b2	1.80	2.20	0.071	0.087
D	19.75	20.05	0.7782	0.7900
D1	13.70	14.10	0.5398	0.5555
E	15.40	15.80	0.6068	0.6225
e	5.45		0.2147	
H	20.55	20.65	0.810	0.814
L	7.40		0.2916	
ΦP	6.90	7.10	0.2719	0.2797
ΦP1	3.20		0.1261	

10 Attentions

- ROUM Semiconductor Technology CO.,LTD. reserves the right to change the specification without prior notice! The customer should obtain the latest version of the information before making the order and verify that the information is complete and up to date.
- It is the responsibility of the purchaser for any failure or failure of any semiconductor product under certain conditions. It is the responsibility of the purchaser to comply with safety standards and to take safety measures in the system design and machine manufacturing of Roma products in order to avoid potential risk of failure. Injury or property damage.
- Product promotion is endless, our company will be dedicated to provide customers with better products.

11 Appendix

Revision history:

Date	REV.	Description	Page
2017.03.09	1.0	Original	