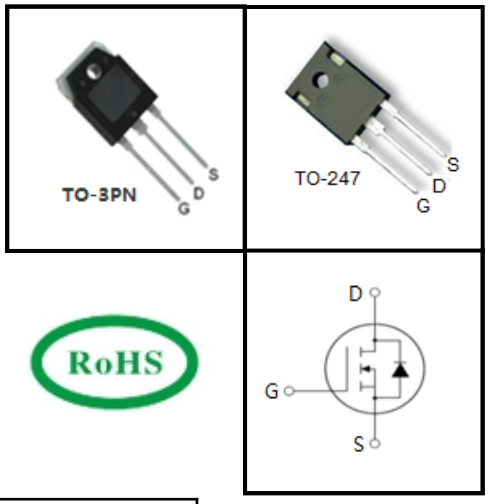
650V Super-Junction Power MOSFET

FEATURES

- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant



APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

RoHS

Device Marking and Package Information		
Device	TPV65R040M	TPW65R040M
Package	TO-3PN	TO-247
Marking	65R040M	65R040M

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted

Parameter		Symbol	Value		Unit
			TO-3PN	TO-247	
Drain-Source Voltage (V_{GS} = 0V)		V_{DSS}	650		V
Continuous Drain Current		I_D	72		A
Pulsed Drain Current	(note1)	I_{DM}	216		A
Gate-Source Voltage		V_{GSS}	±30		V
Single Pulse Avalanche Energy	(note2)	E_{AS}	2185		mJ
Avalanche Current	(note1)	I_{AR}	13.7		A
Repetitive Avalanche Energy	(note1)	E_{AR}	3.31		mJ
Power Dissipation (T_C = 25ºC)		P_D	500		W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150		ºC

Thermal Resistance

Parameter	Symbol	Value		Unit
		TO-3PN	TO-247	
Thermal Resistance, Junction-to-Case	R_{thJC}	0.25		ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62		

Specifications T_J = 25ºC, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Value**			**Unit**
			Min.	**Typ.**	**Max.**	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 650V, V_{GS} = 0V, T_J = 150ºC	--	--	100	
Gate-Source Leakage	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	2.5	--	4.5	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	V_{GS} = 10V, I_D = 25A	--	0.035	0.04	Ω
Forward Transconductance (Note3)	g_{fs}	V_{DS} = 10V, I_D = 25A	--	62	--	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 50V, f = 1.0MHz	--	8051	--	pF
Output Capacitance	C_{oss}		--	865	--	
Reverse Transfer Capacitance	C_{rss}		--	36	--	
Total Gate Charge	Q_g	V_{DD} = 520V, I_D = 50A, V_{GS} = 10V	--	160	--	nC
Gate-Source Charge	Q_{gs}		--	38	--	
Gate-Drain Charge	Q_{gd}		--	60	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 400V, I_D = 50A, R_G = 25Ω	--	45	--	ns
Turn-on Rise Time	t_r		--	161	--	
Turn-off Delay Time	$t_{d(off)}$		--	287	--	
Turn-off Fall Time	t_f		--	87	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	T_C = 25ºC	--	--	72	A
Pulsed Diode Forward Current	I_{SM}		--	--	216	
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 72A, V_{GS} = 0V	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	V_R = 400V, I_F = 30A, di_F/dt = 100A/μs	--	540	--	ns
Reverse Recovery Charge	Q_{rr}		--	13.5	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	50.4	--	A

Notes

1. Repetitive Rating: Pulse Width limited by maximum junction temperature
2. I_{AS} = 13.7A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1%

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics

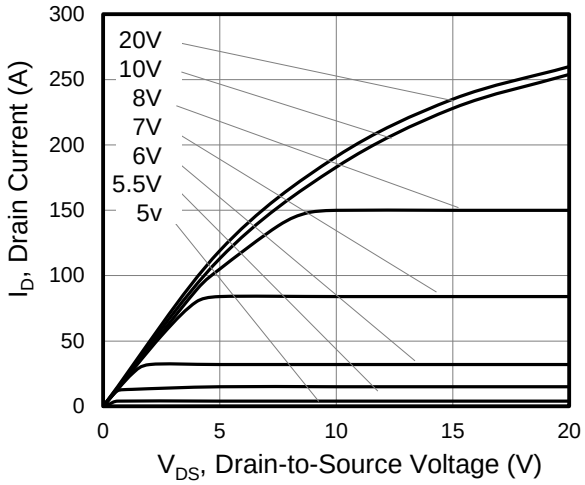


Figure 2. Transfer Characteristics

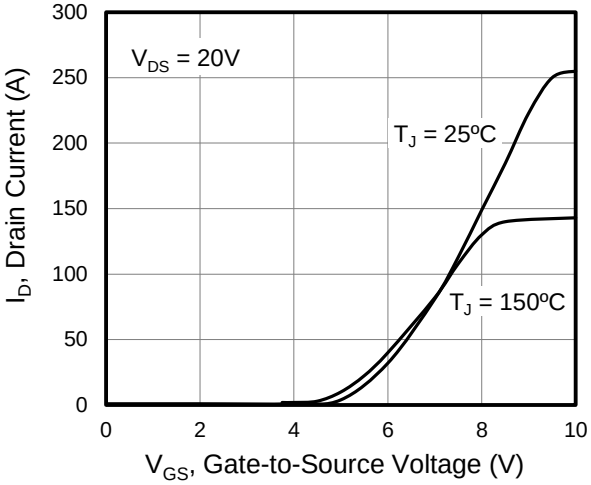


Figure 3. On-Resistance vs. Drain Current

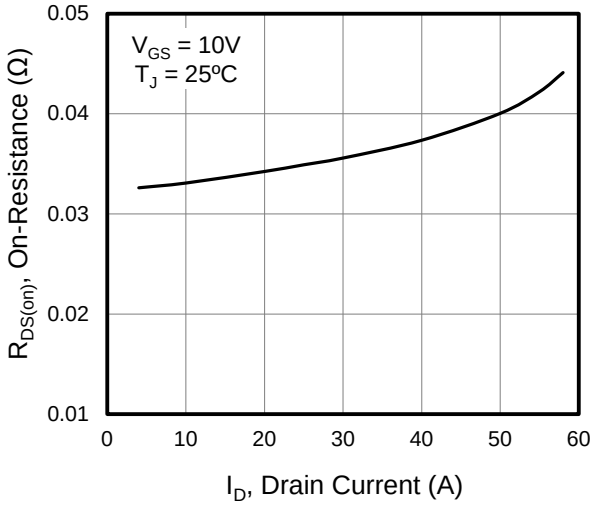


Figure 4. Capacitance

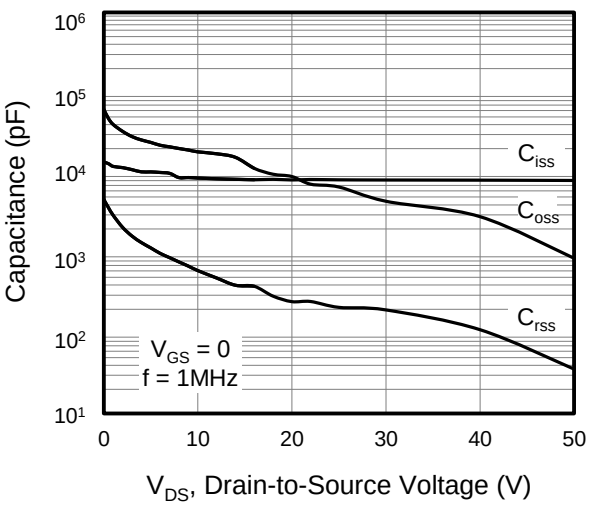


Figure 5. Gate Charge

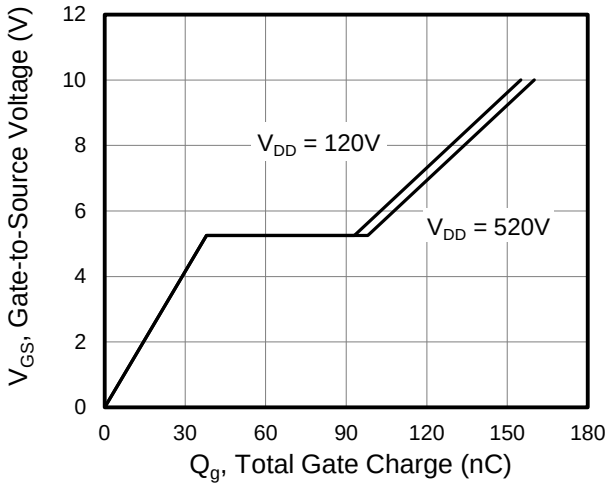
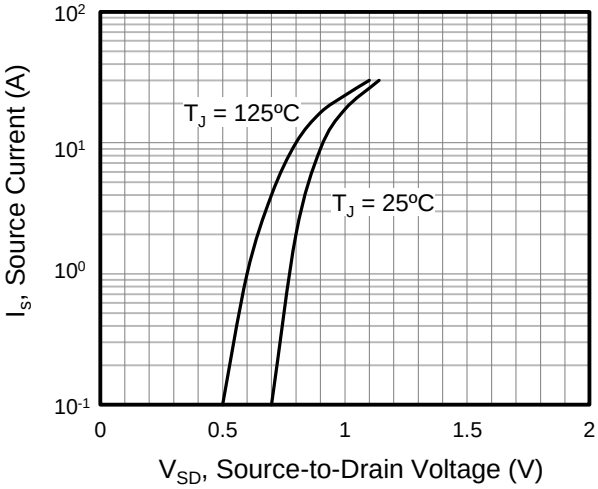


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

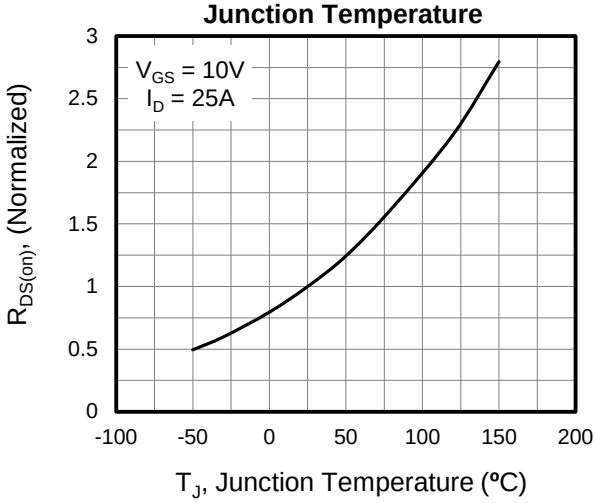


Figure 8. Threshold Voltage vs. Junction Temperature

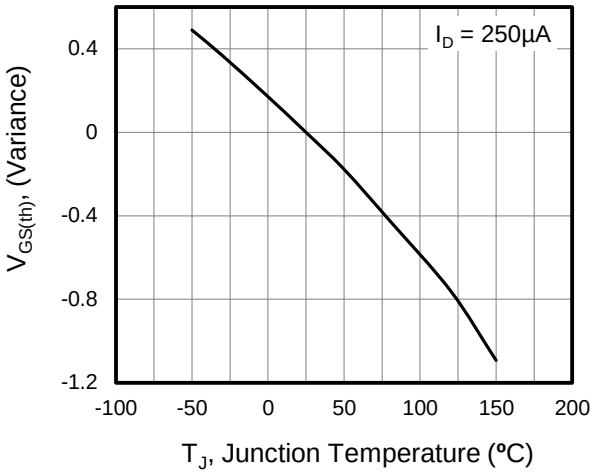


Figure 9. Transient Thermal Impedance TO-3PN/TO-247

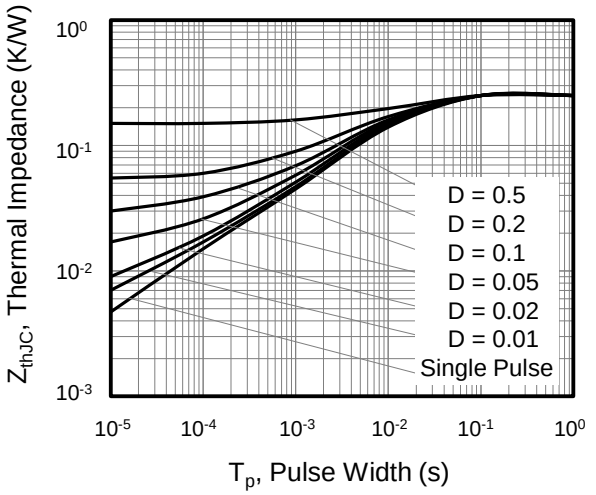


Figure A：Gate Charge Test Circuit and Waveform

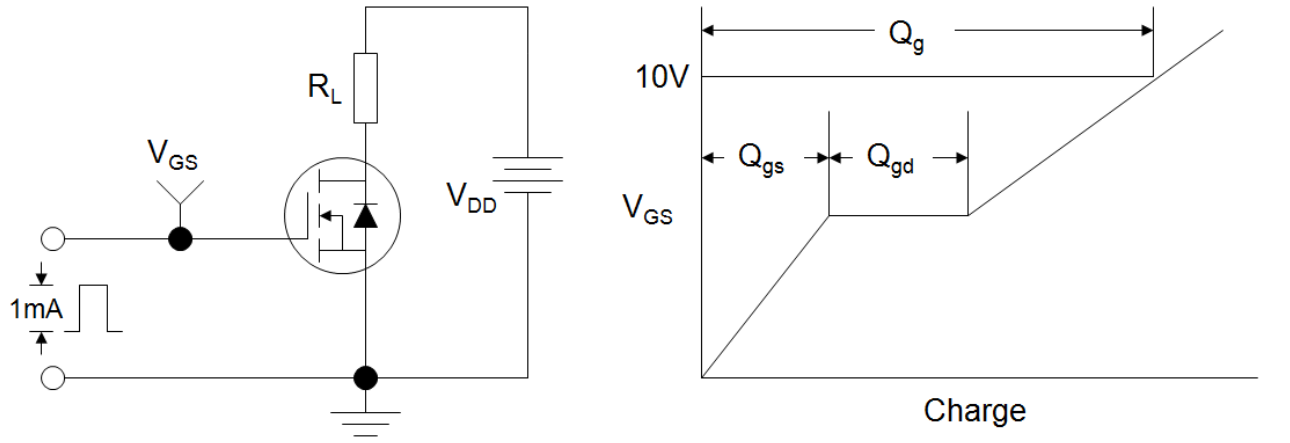


Figure B：Resistive Switching Test Circuit and Waveform

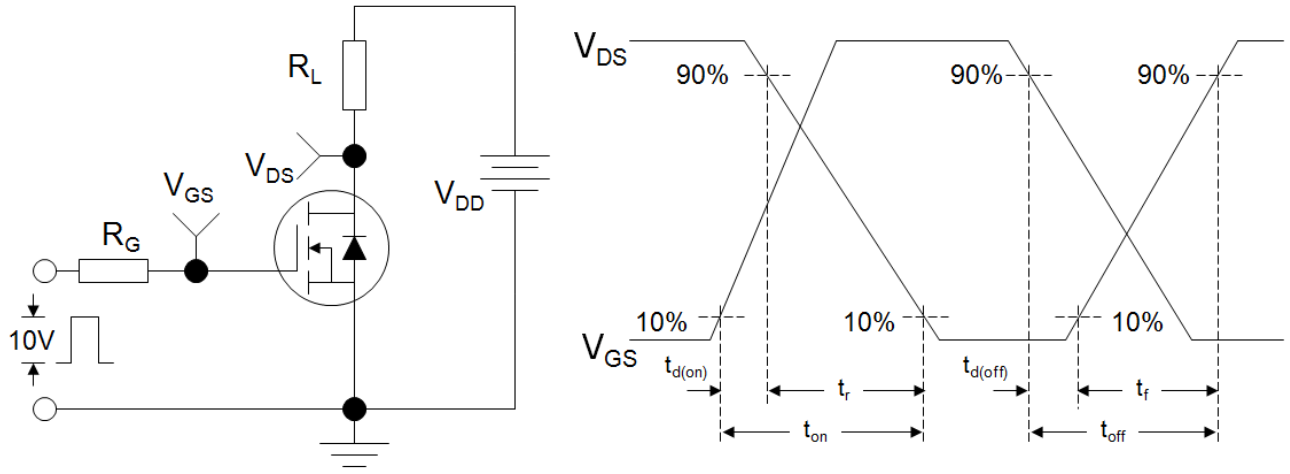
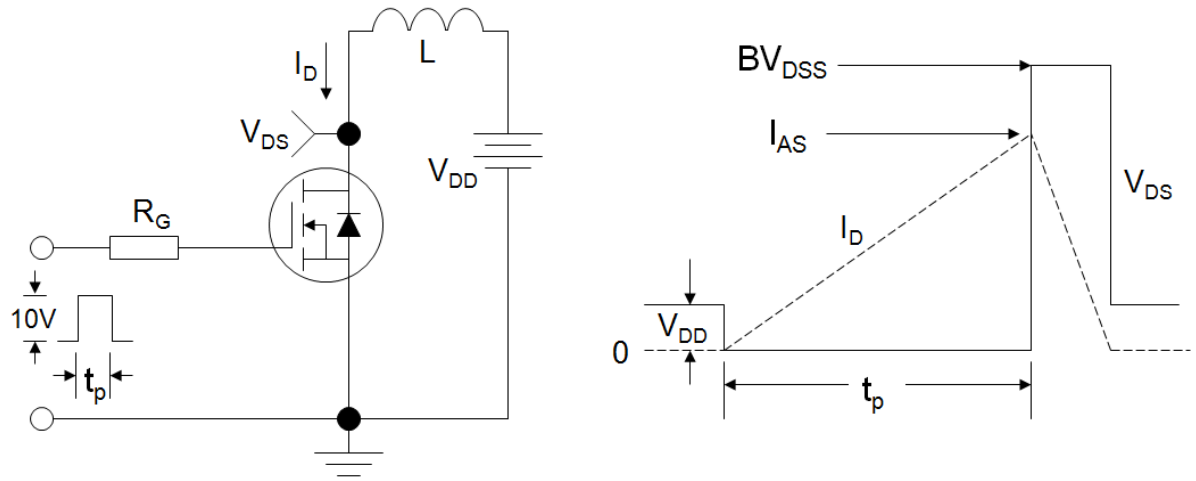
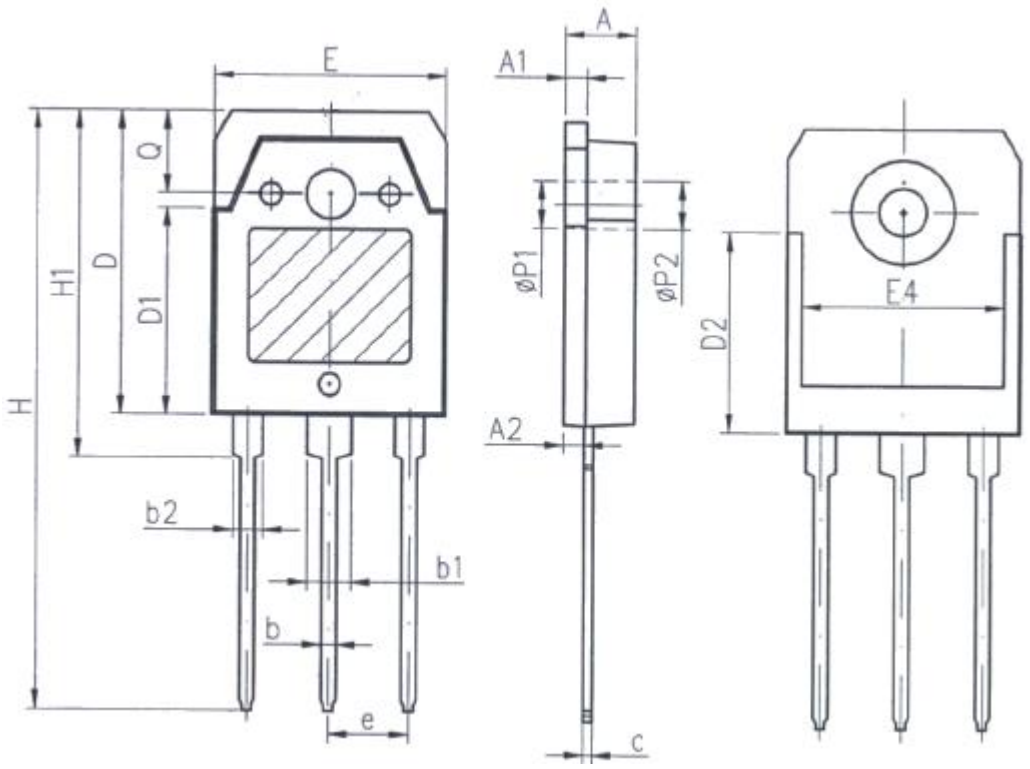


Figure C：Unclamped Inductive Switching Test Circuit and Waveform

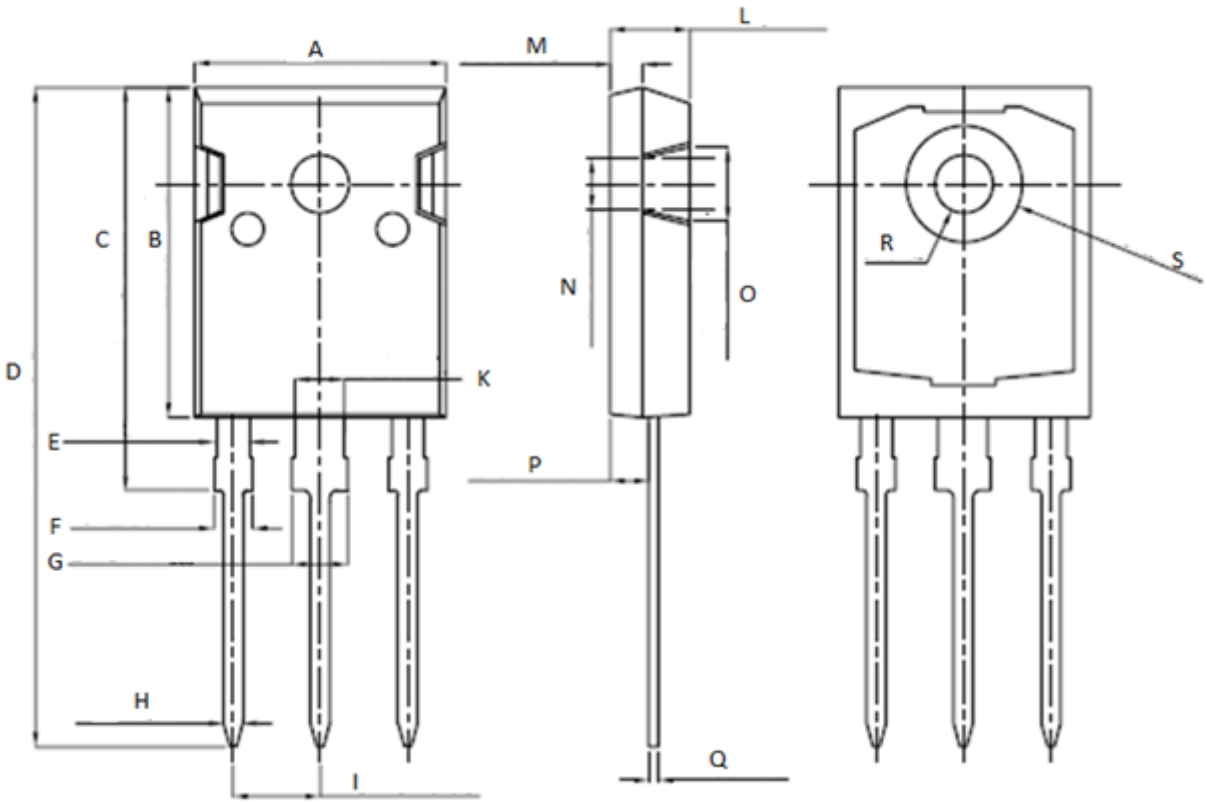


TO-3PN



Unit:mm		
Symbol	Min.	Max.
A	4.6	5
A1	1.4	1.65
A2	1.18	1.58
b	0.8	1.2
b1	2.8	3.2
b2	1.8	2.2
c	0.5	0.75
D	19.6	20.2
D1	13.55	14.25
D2	12.9REF	
E	15.35	15.85
E4	12.6	-
e	5.45TYP	
H	40.1	40.9
H1	23.15	23.65
P1	3.2REF	
P2	3.5REF	

TO-247



Unit: mm		
Symbol	Min.	Max.
A	15.95	16.25
B	20.85	21.25
C	20.95	21.35
D	40.5	40.9
E	1.9	2.1
F	2.1	2.25
G	3.1	3.25
H	1.1	1.3
I	5.40	5.50

Unit: mm		
Symbol	Min.	Max.
K	2.90	3.10
L	4.90	5.30
M	1.90	2.10
N	4.50	4.70
O	5.40	5.60
P	2.29	2.49
Q	0.51	0.71
R	ϕ3.5	ϕ3.7
S	ϕ7.1	ϕ7.3

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