

Features

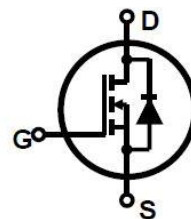
- 650V Super-junction MOSFET
- Low FOM $R_{DS(on)} * Q_g$
- Very high ruggedness capability
- 100% avalanche tested
- RoHS compliant
- JEDEC Qualification

Applications

- Telecom, Server, Solar, UPS and EV charger

N-channel Super-junction MOSFET

BV_{DSS}	I_D	$R_{DS(on)}$
650V	48A	< 0.078Ω



Ordering Part Number	Package	Marking	Remark
TSAN078R65	TO-3PN	TSAN078R65	RoHS

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	650	V
Gate-Source Voltage	V_{GS}	±30	V
Continuous Drain Current	I_D	$T_C = 25\text{ °C}$	48
		$T_C = 100\text{ °C}$	28
Pulsed Drain Current (Note 1)	I_{DM}	144	A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	1508	mJ
Repetitive Avalanche Current (Note 1)	I_{AR}	9.6	A
Repetitive Avalanche Energy (Note 1)	E_{AR}	41.7	mJ
Power Dissipation	P_D	$T_C = 25\text{ °C}$	417
		Derate above 25 °C	3.3
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	°C
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	T_L	300	°C

* Limited only by maximum junction temperature

Thermal Characteristics

Parameter	Symbol	Value	Unit
Maximum Thermal resistance, Junction-to-Case	$R_{\theta JC}$	0.3	°C/W
Maximum Thermal resistance, Junction-to-Ambient	$R_{\theta JA}$	40	°C/W

Electrical Characteristics : $T_C=25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Test condition	Min	Typ	Max	Unit
OFF						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 520\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
Forward Gate-Source Leakage Current	I_{GSSF}	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
Reverse Gate-Source Leakage Current	I_{GSSR}	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

ON

Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2.5	--	4.5	V
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 24\text{ A}$	--	66	78	$\text{m}\Omega$
Forward Transconductance (Note 4)	g_{FS}	$V_{DS} = 30\text{ V}, I_D = 24\text{ A}$	--	45	--	S

DYNAMIC

Input Capacitance	C_{iss}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	5234	--	pF
Output Capacitance	C_{oss}		--	3918	--	pF
Reverse Transfer Capacitance	C_{riss}		--	43	--	pF

SWITCHING

Turn-On Delay Time (Note 4,5)	$t_{d(on)}$	$V_{DD} = 325\text{ V}, I_D = 48\text{ A},$ $R_G = 25\ \Omega, V_{GS} = 10\text{ V}$	--	82	--	ns
Turn-On Rise Time (Note 4,5)	t_r		--	186	--	ns
Turn-Off Delay Time (Note 4,5)	$t_{d(off)}$		--	352	--	ns
Turn-Off Fall Time (Note 4,5)	t_f		--	111	--	ns
Total Gate Charge (Note 4,5)	Q_g	$V_{DS} = 520\text{ V}, I_D = 48\text{ A},$ $V_{GS} = 10\text{ V}$	--	131	--	nC
Gate-Source Charge (Note 4,5)	Q_{gs}		--	24	--	nC
Gate-Drain Charge (Note 4,5)	Q_{gd}		--	58	--	nC

SOURCE DRAIN DIODE

Maximum Continuous Drain-Source Diode Forward Current	I_S	----	--	--	48	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}	----	--	--	144	A
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 48\text{ A}$	--	--	1.25	V
Reverse Recovery Time (Note 4)	t_{rr}	$V_{GS} = 0\text{ V}, I_S = 48\text{ A}$	--	654	--	ns
Reverse Recovery Charge (Note 4)	Q_{rr}	$di_F / dt = 100\text{ A}/\mu\text{s}$	--	14.7	--	μC

- Note :
1. Repeated rating : Pulse width limited by safe operating area
 2. $I_{AS} = 9.6\text{ A}, R_G = 25\text{ ohm}$, starting $T_J = 25^\circ\text{C}$, not subject to production test – verified by design/characterization
 3. $I_{SD} \leq 48\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DS}$, Starting $T_J = 25^\circ\text{C}$
 4. Pulse Test : Pulse width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$
 5. Essentially Independent of Operating Temperature Typical Characteristics

Fig. 1 Output Characteristics

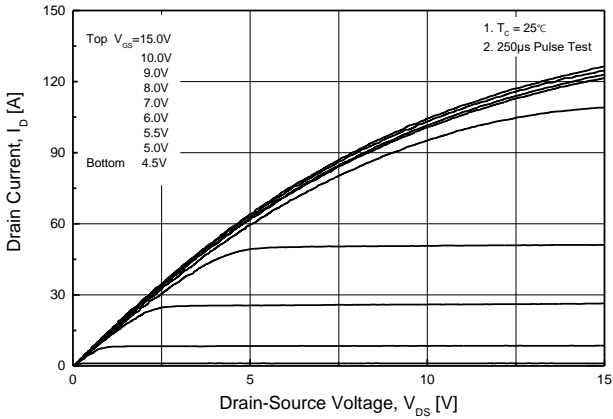


Fig. 2 Transfer Characteristics

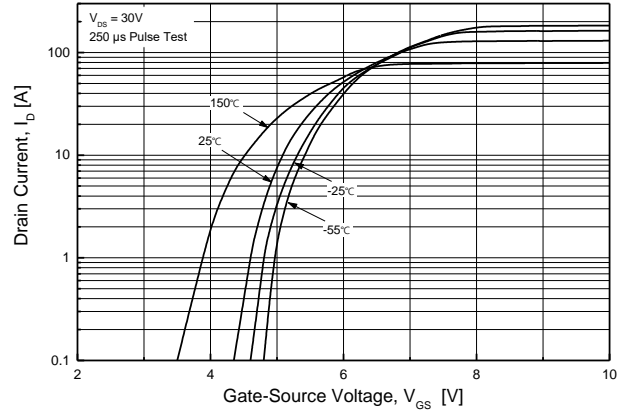


Fig. 3 On-Resistance vs. Drain Current and Gate voltage

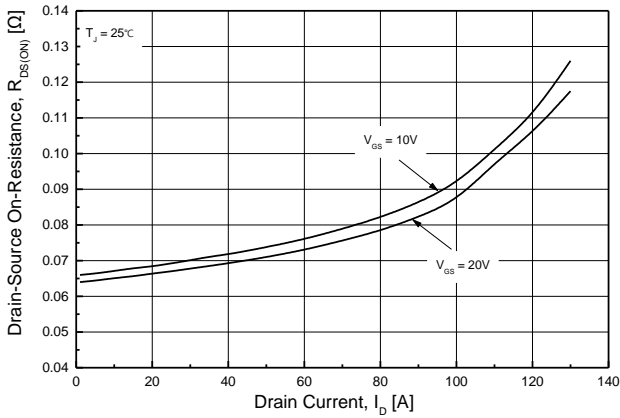


Fig. 4 Body Diode Forward Voltage vs. Source Current and Temperature

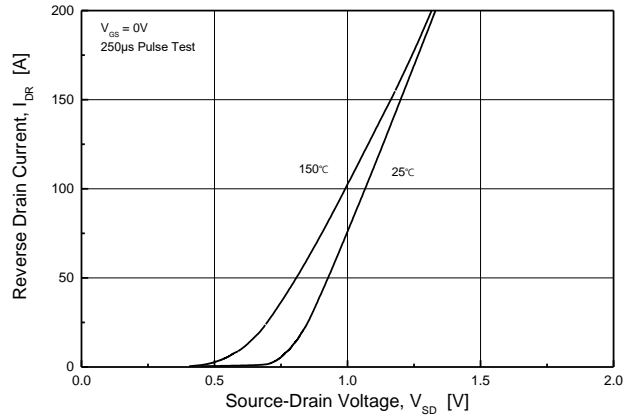


Fig. 5 Capacitance Characteristics

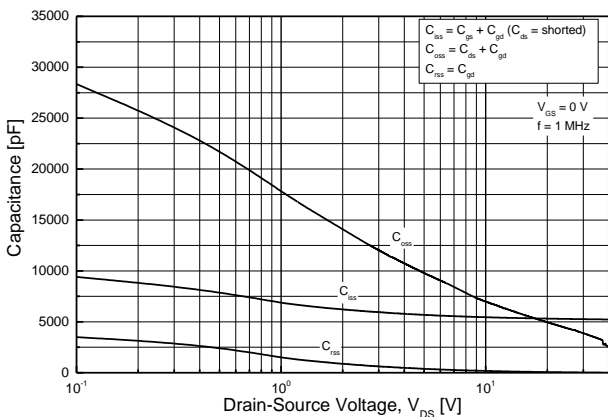


Fig. 6 Gate Charge Characteristics

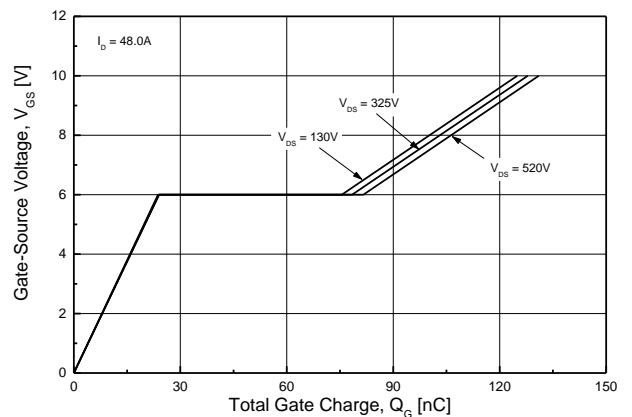


Fig. 7 Breakdown Voltage vs. Temperature

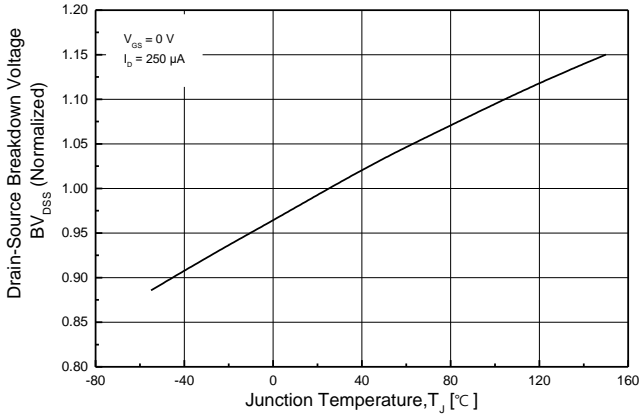


Fig. 8 On-Resistance vs. Temperature

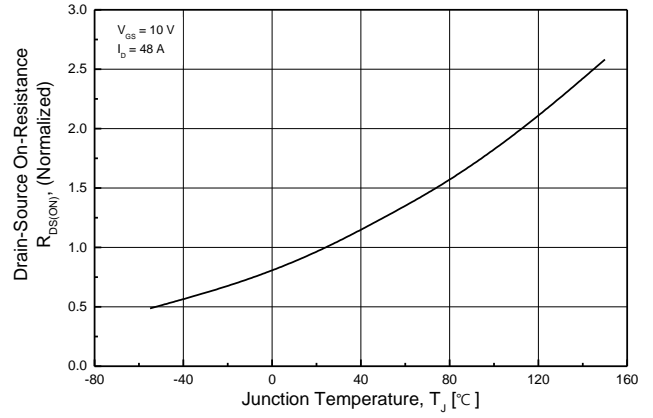


Fig. 9 Maximum Drain Current vs. Case Temperature

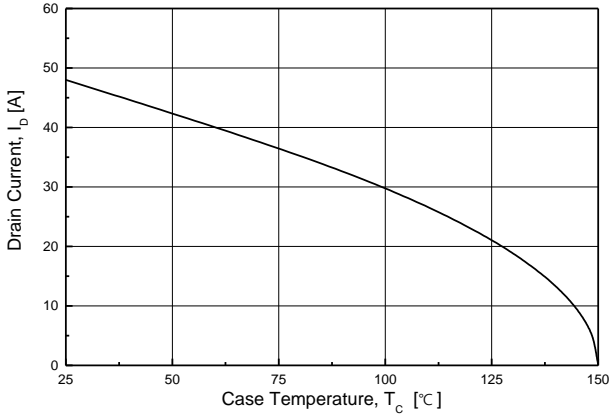


Fig. 10 Gate Threshold Voltage vs. Junction Temperature

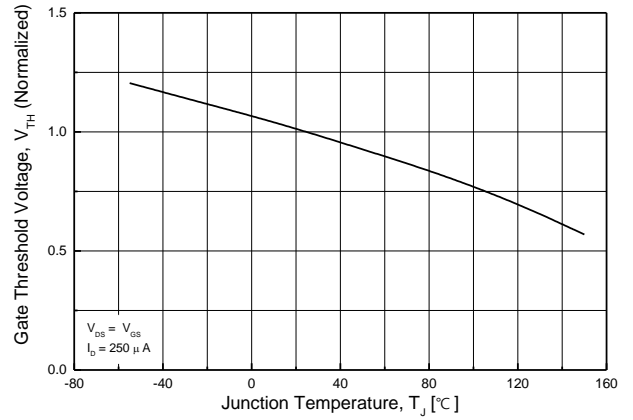


Fig. 11 Maximum Safe Operating Area

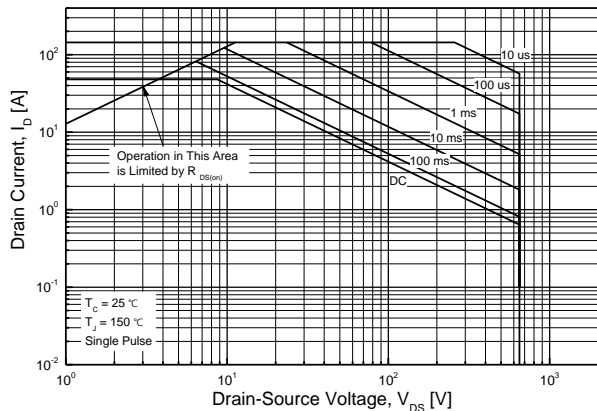
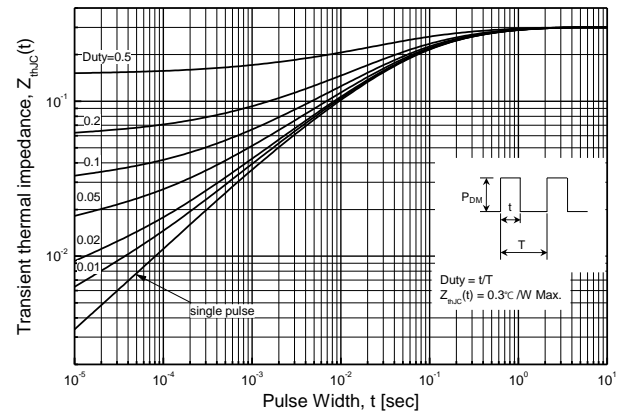
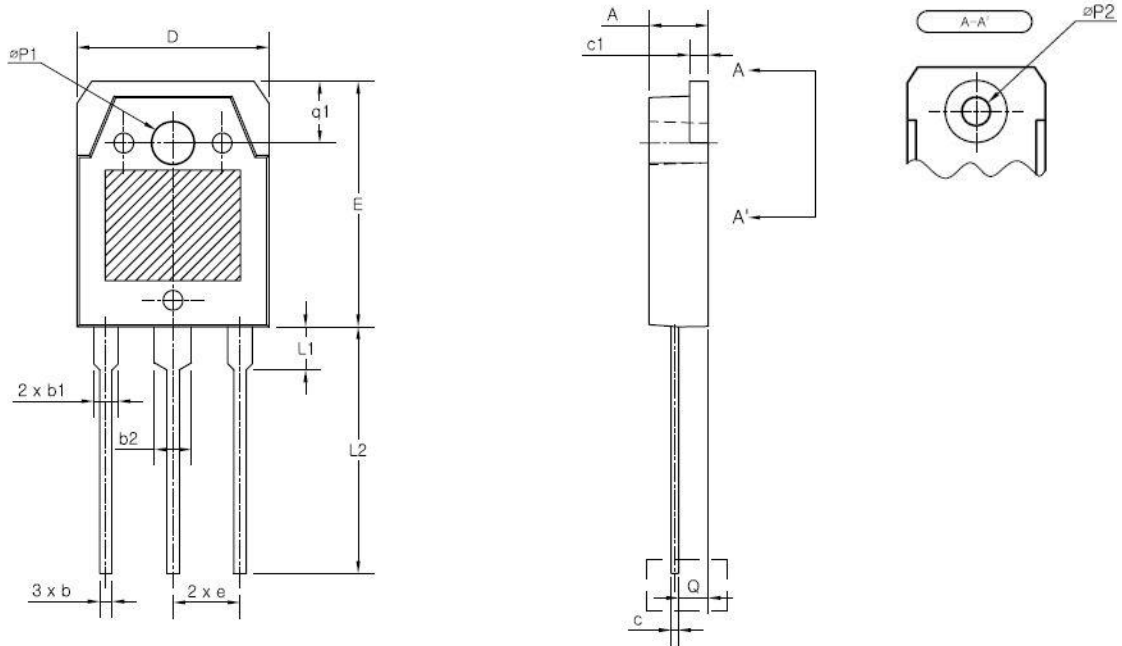


Fig. 12 Transient Thermal Response Curve



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
$\varnothing P1$	3.30	3.40	3.50
$\varnothing P2$	(3.20)		
Q	2.20	2.40	2.60
q1	4.80	5.00	5.20

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