

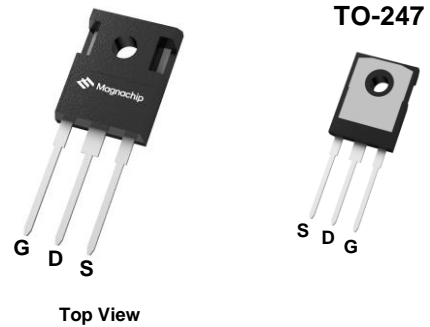


# MDQ20N116PTTH

Single N-channel Trench MOSFET 200V 11.6mΩ 95A

## FEATURES

- Trench Power MOSFET technology
- N-channel, normal level
- Enhanced avalanche ruggedness
- 100% UIS and Rg tested
- Maximum 175°C junction temperature

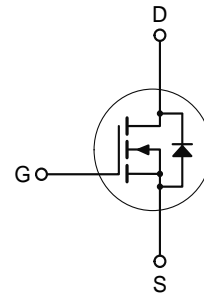


## APPLICATIONS

- DC/DC and AC/DC converters
- Brushed and BLDC Motor drive systems
- Battery powered systems

## KEY PERFORMANCE PARAMETERS

$V_{DS}$	200	V
$R_{DS(on), typ.}$	0.0106	$\Omega$
$I_D$	95	A
$Q_G, typ.$	83	nC
Junction temperature, $_{max.}$	175	$^{\circ}C$



## ORDERING INFORMATION

Type / Ordering Code	Package	Marking	Packing	RoHS Status
MDQ20N116PTTH	TO-247	MDQ20N116	Tube	Halogen Free

<http://www.magnachip.com/>

**ABSOLUTE MAXIMUM RATINGS**, at  $T_J = 25^\circ\text{C}$ , unless otherwise specified

PARAMETER		SYMBOL	RATING	UNIT
Drain-source Voltage		$V_{DS}$	200	V
Gate-source Voltage		$V_{GS}$	$\pm 20$	V
Drain current	$T_C=25^\circ\text{C}$	$I_D$	95	A
	$T_C=100^\circ\text{C}$		67	A
<sup>1)</sup> Pulsed drain current	$T_C=25^\circ\text{C}$	$I_{DM}$	380	A
Total power dissipation	$T_C=25^\circ\text{C}$	$P_{tot}$	300	W
	$T_C=100^\circ\text{C}$		150	W
<sup>2)</sup> Avalanche energy, single pulse		$E_{AS}$	365	mJ
Operating and storage temperature		$T_j, T_{stg}$	- 55 ~ 175	$^\circ\text{C}$

**THERMAL RESISTANCE RATINGS**

PARAMETER		SYMBOL	RATING	UNIT
Thermal resistance, junction - case		$R_{\theta JC}$	0.5	$^\circ\text{C}/\text{W}$
<sup>3)</sup> Thermal resistance, junction - ambient		$R_{\theta JA}$	40	$^\circ\text{C}/\text{W}$

**Notes**

- Pulse width limited by  $T_{jmax}$
- Starting  $T_J=25^\circ\text{C}$ ,  $L=1\text{mH}$ ,  $I_{AS}=27\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $V_{GS}=10\text{V}$
- Surface mounted FR-4 board by JEDEC (jesd51-7)

ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ )

## Static

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Drain-source breakdown voltage	$V_{(BR)DSS}$	200	-	-	V	$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	3.00	3.75	4.50	V	$V_{DS}=V_{GS}, I_D=250\ \mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	-	1	$\mu\text{A}$	$V_{DS}=200\text{ V}, V_{GS}=0\text{ V}$
Gate-source leakage current	$I_{GSS}$	-	-	$\pm 100$	nA	$V_{GS}=\pm 20\text{ V}, V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	10.6	11.6	m $\Omega$	$V_{GS}=10\text{ V}, I_D=50\text{ A}$
Gate resistance	$R_G$	-	3.0	-	$\Omega$	f=1MHz
Transconductance	$g_{fs}$	-	90	-	S	$V_{DS}=10\text{ V}, I_D=50\text{ A}$

## Dynamic

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Input capacitance	$C_{iss}$	-	6869	-	pF	$V_{GS}=0\text{ V}, V_{DS}=100\text{ V}, f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	402	-	pF	$V_{GS}=0\text{ V}, V_{DS}=100\text{ V}, f=1\text{ MHz}$
Reverse transfer capacitance	$C_{rss}$	-	8	-	pF	$V_{GS}=0\text{ V}, V_{DS}=100\text{ V}, f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	37	-	ns	$V_{DD}=100\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=3\ \Omega$
Rise time	$t_r$	-	12	-	ns	$V_{DD}=100\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=3\ \Omega$
Turn-off delay time	$t_{d(off)}$	-	62	-	ns	$V_{DD}=100\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=3\ \Omega$
Fall time	$t_f$	-	8	-	ns	$V_{DD}=100\text{ V}, V_{GS}=10\text{ V}, I_D=50\text{ A}, R_{G,ext}=3\ \Omega$

## Gate charge characteristics

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Gate to source charge	$Q_{gs}$	-	39	-	nC	$V_{DD}=100\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate charge at threshold	$Q_{gs(th)}$	-	22	-	nC	$V_{DD}=100\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate to drain charge	$Q_{gd}$	-	12	-	nC	$V_{DD}=100\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Switching charge	$Q_{sw}$	-	29	-	nC	$V_{DD}=100\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate charge total	$Q_g$	-	83	-	nC	$V_{DD}=100\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	5.9	-	V	$V_{DD}=100\text{ V}, I_D=50\text{ A}, V_{GS}=0\text{ to }10\text{ V}$

## Source-Drain Diode Ratings and Characteristics

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Diode continuous forward current	$I_S$	-	-	95	A	-
Diode pulse current	$I_{S,pulse}$	-	-	380	A	pulsed; $t_p \leq 10\ \mu\text{s}$
Diode forward voltage	$V_{SD}$	-	0.9	1.2	V	$V_{GS}=0\text{ V}, I_F=50\text{ A}$
Reverse recovery time	$t_{rr}$	-	167	-	ns	$I_F=50\text{ A}, d_{IF}/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$	-	1010	-	nC	$I_F=50\text{ A}, d_{IF}/dt=100\text{ A}/\mu\text{s}$

Electrical Characteristics Diagrams (25 °C, unless otherwise noted)

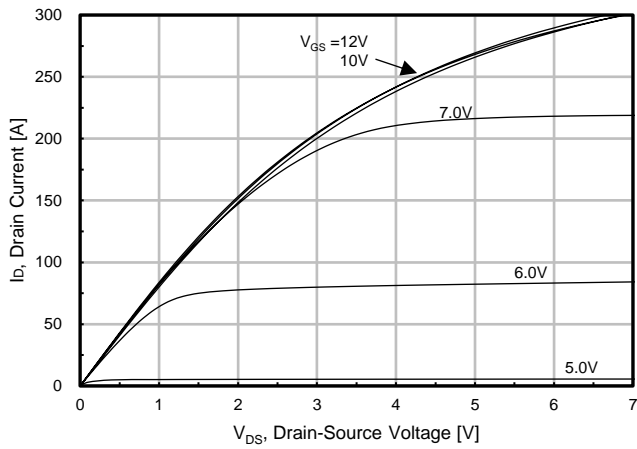


Fig. 1. Output Characteristics (25°C)

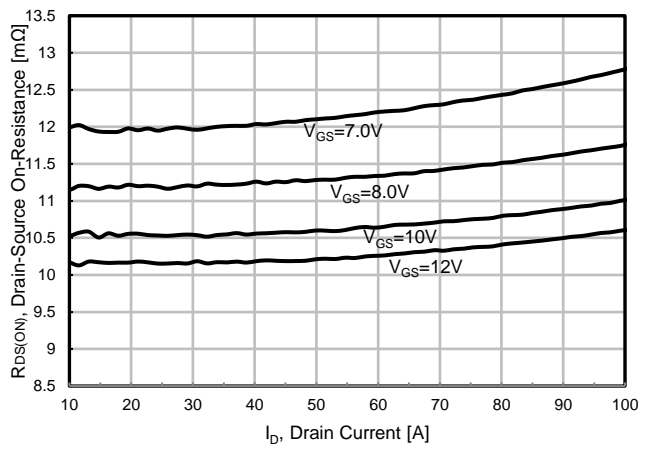


Fig. 2. Static On-Resistance Variation

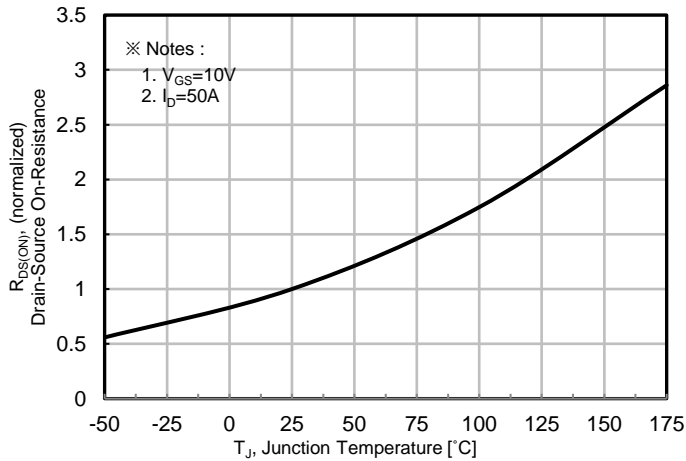


Fig. 3. On-Resistance vs. Junction Temperature

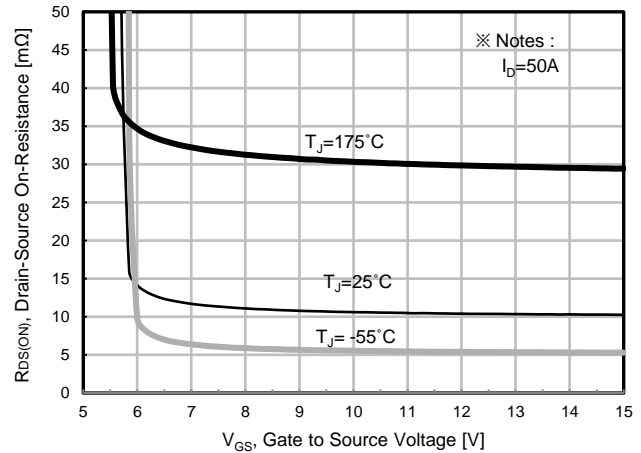


Fig. 4. On-Resistance vs. Gate to source Voltage

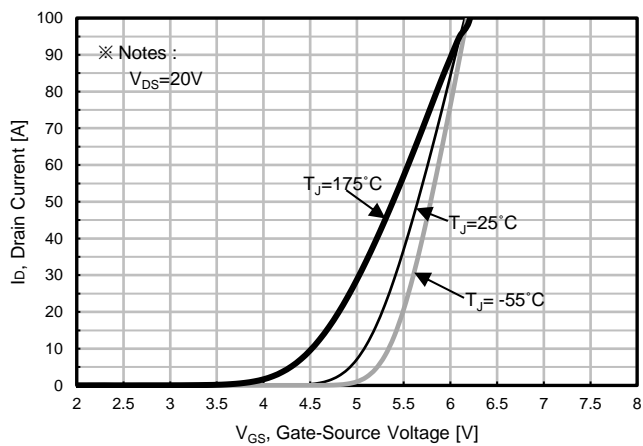


Fig. 5. Transfer Characteristics

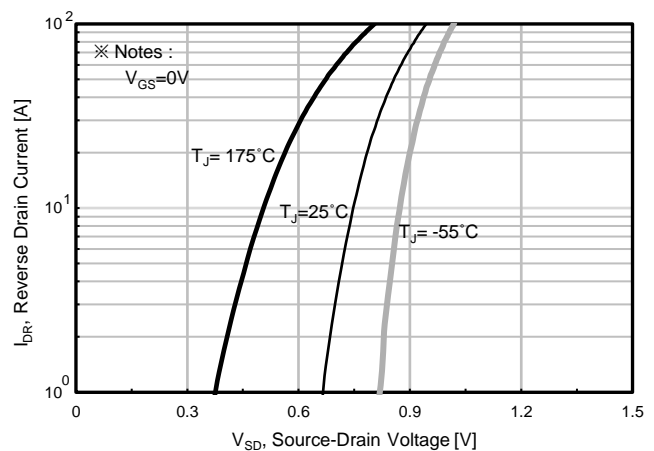


Fig. 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Electrical Characteristics Diagrams (25 °C, unless otherwise noted)

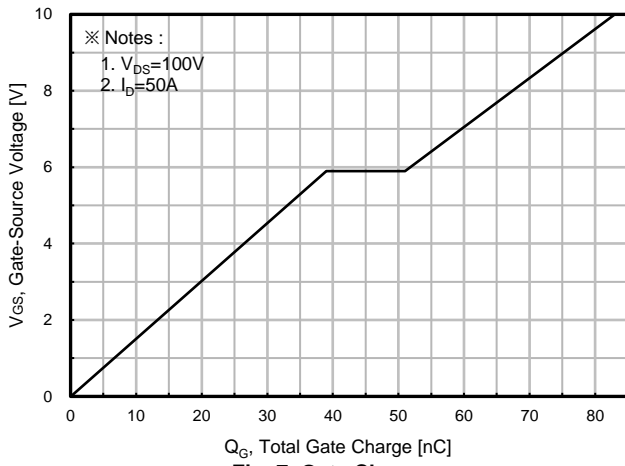


Fig. 7. Gate Charge

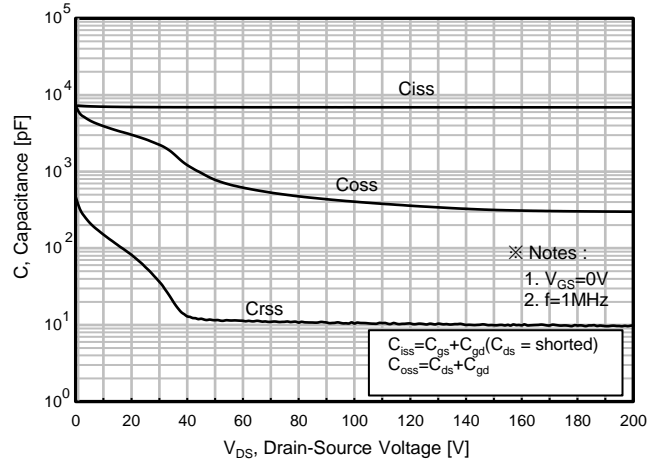


Fig. 8. Capacitance

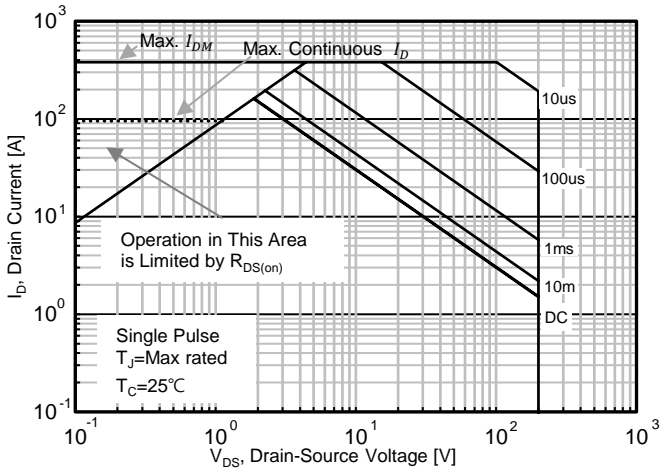


Fig. 9. Safe Operating Area, Junction-to-Ambient

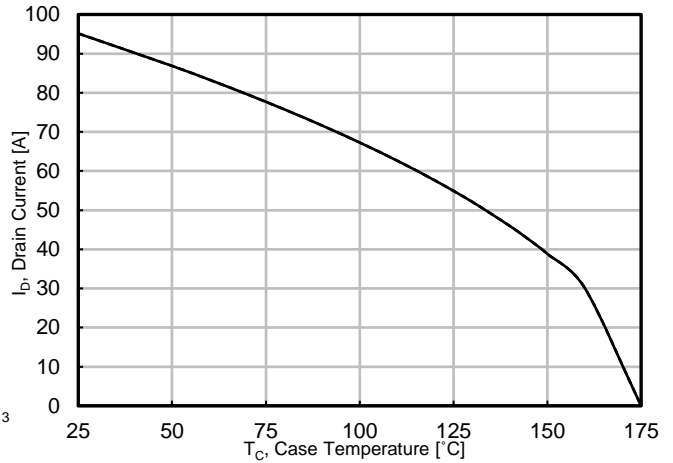


Fig. 10. Maximum Drain vs. Case Temperature

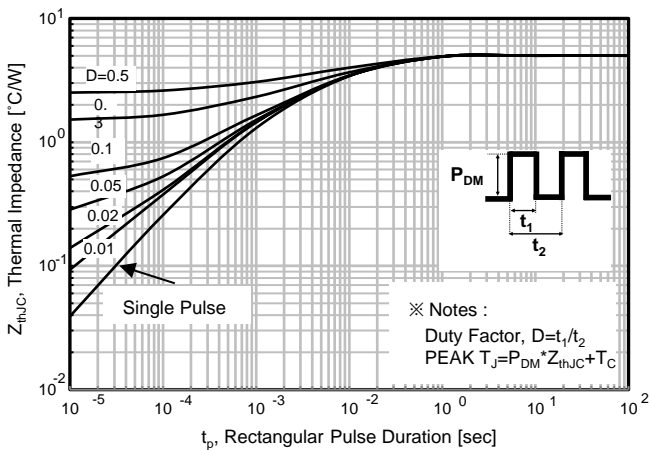


Fig. 11. Transient Thermal Impedance Junction to Case (Rthjc)

## Electrical Characteristics Diagrams (25 °C, unless otherwise noted)

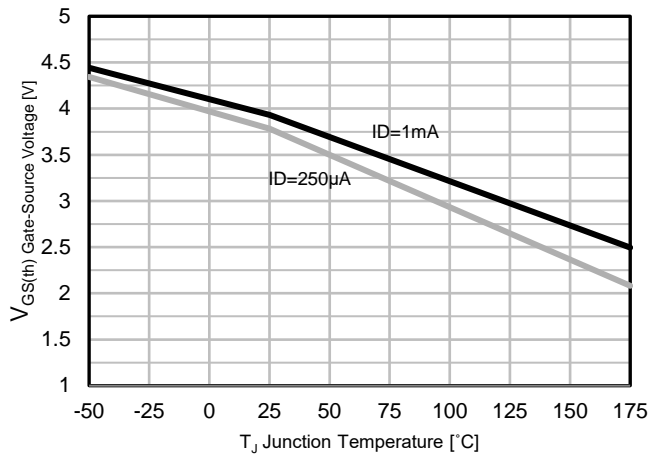


Fig.12 Gate -Source Threshold Voltage vs. Temperature

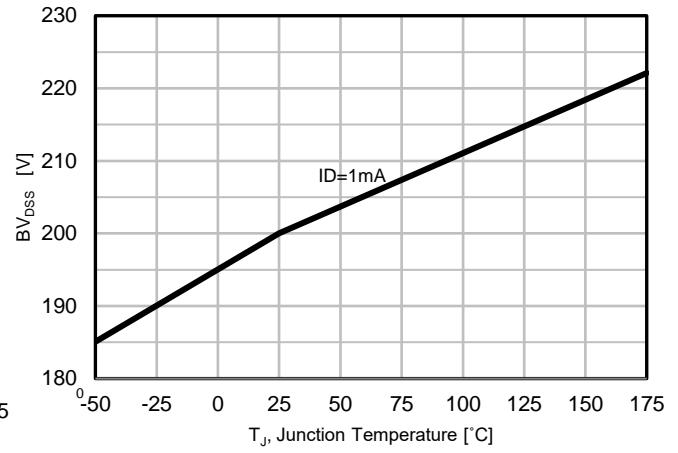
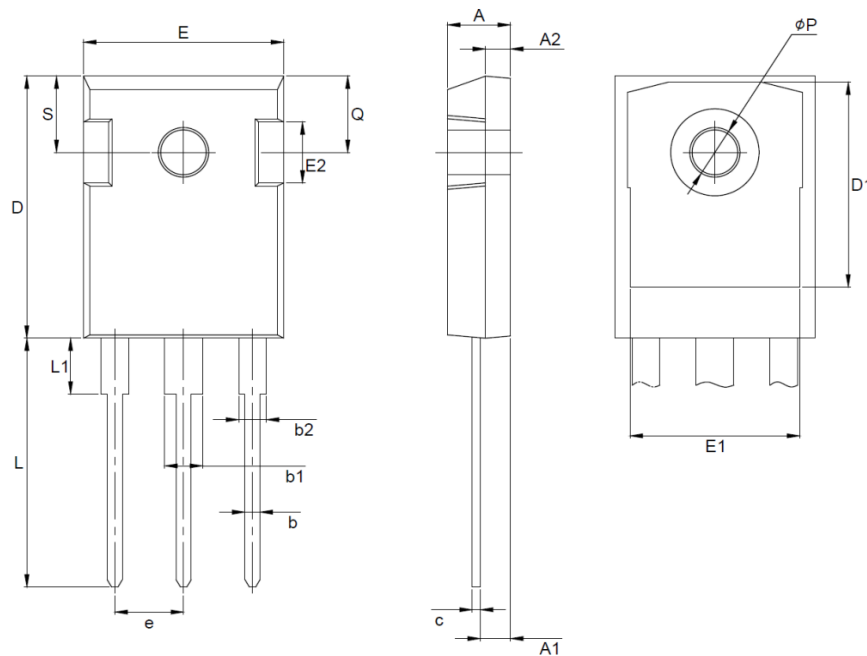


Fig.13 Drain-Source Voltage vs. Temperature

# Package Information

## TO-247




Symbol	Dimension (mm)		
	Min	Nom	Max
A	4.70	–	5.31
A1	2.20	–	2.60
A2	1.50	–	2.49
b	0.99	–	1.40
b1	2.59	–	3.43
b2	1.65	–	2.39
c	0.38	–	0.89
D	20.30	–	21.46
D1	13.08	–	–
E	15.45	–	16.26
E1	13.06	–	14.15
E2	4.32	–	5.49
e	5.45 BSC		
L	19.81	–	20.57
L1	–	–	4.50
φP	3.50	–	3.70
Q	5.38	–	6.20
S	6.15 BSC		

### Notes

Package body size, length and width do not include mold flash, protrusions and gate burrs.

**DISCLAIMER :**

The Products are not designed for use in hostile environments, including, without limitation, aircraft, nuclear power generation, medical appliances, and devices or systems in which malfunction of any Product can reasonably be expected to result in a personal injury. Seller's customers using or selling Seller's products for use in such applications do so at their own risk and agree to fully defend and indemnify Seller.

Magnachip reserves the right to change the specifications and circuitry without notice at any time. Magnachip does not consider responsibility for use of any circuitry other than circuitry entirely included in a Magnachip product.  Magnachip are registered trademarks of Magnachip Semiconductor Ltd.