

Power MOSFET Stage for Boost Converters

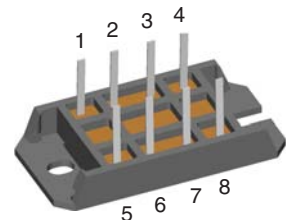
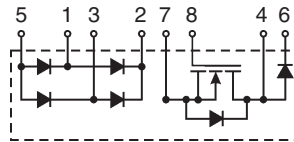
Module for Power Factor Correction

$$I_{D25} = 47 \text{ A}$$

$$V_{DSS} = 500 \text{ V}$$

$$R_{DS(on)} = 0.12 \Omega$$

$V_{RRM(Diode)}$	V_{DSS}	Type
V	V	
600	500	VUM 33-05N



Symbol	Conditions	Maximum Ratings		
V_{DSS}	$T_{VJ} = 25^{\circ}\text{C}$ to 150°C	500	V	
V_{DGR}	$T_{VJ} = 25^{\circ}\text{C}$ to 150°C ; $R_{GS} = 10 \text{ k}\Omega$	500	V	
V_{GS}	Continuous	± 20	V	
I_D	MOSFET $T_S = 85^{\circ}\text{C}$	33	A	
I_D		$T_S = 25^{\circ}\text{C}$	47	A
I_{DM}		$T_S = 25^{\circ}\text{C}$, $t_p = \textcircled{1}$	130	A
P_D	$T_S = 85^{\circ}\text{C}$	310	W	
I_S	$V_{GS} = 0 \text{ V}$, $T_S = 25^{\circ}\text{C}$	33	A	
I_{SM}	$V_{GS} = 0 \text{ V}$, $T_S = 25^{\circ}\text{C}$, $t_p = \textcircled{1}$	130	A	
V_{RRM}	Boost Diode $T_S = 85^{\circ}\text{C}$, rectangular $\delta = 0.5$	600	V	
I_{FAV}		33	A	
I_{FSM}		$T_{VJ} = 45^{\circ}\text{C}$, $t = 10 \text{ ms}$ (50 Hz)	300	A
	$t = 8.3 \text{ ms}$ (60 Hz)	320	A	
	$T_{VJ} = 150^{\circ}\text{C}$, $t = 10 \text{ ms}$ (50 Hz)	260	A	
	$t = 8.3 \text{ ms}$ (60 Hz)	280	A	
P	$T_S = 85^{\circ}\text{C}$	59	W	
V_{RRM}	Rectifier Diodes $T_S = 85^{\circ}\text{C}$, sinus 180°	1200	V	
I_{dAV}		54	A	
I_{FSM}		$T_{VJ} = 45^{\circ}\text{C}$, $t = 10 \text{ ms}$ (50 Hz)	300	A
	$t = 8.3 \text{ ms}$ (60 Hz)	320	A	
	$T_{VJ} = 150^{\circ}\text{C}$, $t = 10 \text{ ms}$ (50 Hz)	260	A	
	$t = 8.3 \text{ ms}$ (60 Hz)	280	A	
P	$T_S = 85^{\circ}\text{C}$	50	W	
T_{VJ}	Module	-40...+150	$^{\circ}\text{C}$	
T_{JM}		150	$^{\circ}\text{C}$	
T_{stg}		-40...+150	$^{\circ}\text{C}$	
V_{ISOL}	50/60 Hz	$t = 1 \text{ min}$	3000	V~
	$I_{ISOL} \leq 1 \text{ mA}$	$t = 1 \text{ s}$	3600	V~
M_d	Mounting torque (M5)	2-2.5/18-22 Nm/lb.in.		
Weight		28	g	

Features

- Package with DCB ceramic base plate
- Soldering connections for PCB mounting
- Isolation voltage 3600 V~
- Low $R_{DS(on)}$ HDMOS™ process
- Low package inductance for high speed switching
- Ultrafast boost diode
- Kelvin source for easy drive

Applications

- Power factor pre-conditioner for SMPS, UPS, battery chargers and inverters
- Boost topology for SMPS including 1~ rectifier bridge
- Power supply for welding equipment

Advantages

- 3 functions in one package
- Output power up to 8 kW
- No external isolation
- Easy to mount with two screws
- Suitable for wave soldering
- High temperature and power cycling capability
- Fits easily to all available PFC controller ICs

$\textcircled{1}$ Pulse width limited by T_{VJ}

Symbol	Conditions	Characteristic Values ($T_{VJ} = 25^{\circ}\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_{DSS}	$V_{GS} = 0\text{ V}, I_D = 2\text{ mA}$	500		V
$V_{GS(th)}$	$V_{DS} = 20\text{ V}, I_D = 20\text{ mA}$	2		V
I_{GSS}	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			± 500 nA
I_{DSS}	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$			2 mA
$R_{DS(on)}$	$T_{VJ} = 25^{\circ}\text{C}$			0.12 Ω
R_{Gint}	$T_{VJ} = 25^{\circ}\text{C}$			1.5 Ω
g_{fs}	$V_{DS} = 15\text{ V}, I_{DS} = 12\text{ A}$		30	S
V_{DS}	$I_{DS} = 24\text{ A}, V_{GS} = 0\text{ V}$			1.5 V
$t_{d(on)}$	} $V_{DS} = 250\text{ V}, I_{DS} = 12\text{ A}, V_{GS} = 10\text{ V}$ } $Z_{gen} = 1\ \Omega, L\text{-load}$			100 ns
$t_{d(off)}$				220 ns
C_{iss}	} $V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$		8.5	nF
C_{oss}			0.9	nF
C_{rss}			0.3	nF
Q_g	$V_{DS} = 250\text{ V}, I_D = 12\text{ A}, V_{GS} = 10\text{ V}$		350	nC
R_{thJH}	with heat transfer paste			0.21 K/W
V_F	$I_F = 33\text{ A}; T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 150^{\circ}\text{C}$			1.75 V
				1.5 V
I_R	$V_R = 600\text{ V}, T_{VJ} = 25^{\circ}\text{C}$ $V_R = 480\text{ V}, T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			1.5 mA
				0.25 mA
				7 mA
V_{T0}	For power-loss calculations only $T_{VJ} = 125^{\circ}\text{C}$			1.21 V
r_T				9 m Ω
I_{RM}	$I_F = 30\text{ A}; -di_F/dt = 240\text{ A}/\mu\text{s}$ $V_R = 350\text{ V}, T_{VJ} = 100^{\circ}\text{C}$	10		11 A
R_{thJH}	with heat transfer paste			1.1 K/W
V_F	$I_F = 20\text{ A}, T_{VJ} = 25^{\circ}\text{C}$ $T_{VJ} = 125^{\circ}\text{C}$			1.5 V
I_R	$V_R = 1200\text{ V}, T_{VJ} = 25^{\circ}\text{C}$ $V_R = 0.8 \cdot V_{RRM}, T_{VJ} = 125^{\circ}\text{C}$			0.25 mA
V_{T0}	For power-loss calculations only $T_{VJ} = 125^{\circ}\text{C}$			1.18 V
r_T				12 m Ω
R_{thJH}	with heat transfer paste			1.3 K/W

Dimensions in mm (1 mm = 0.0394")

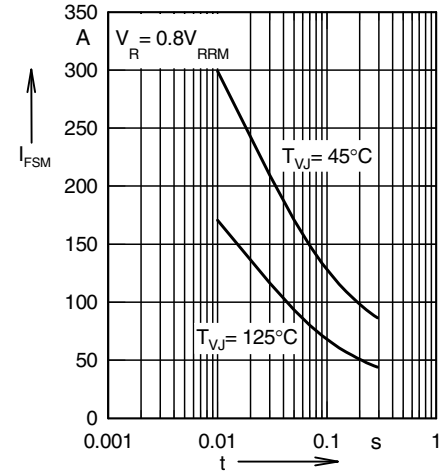
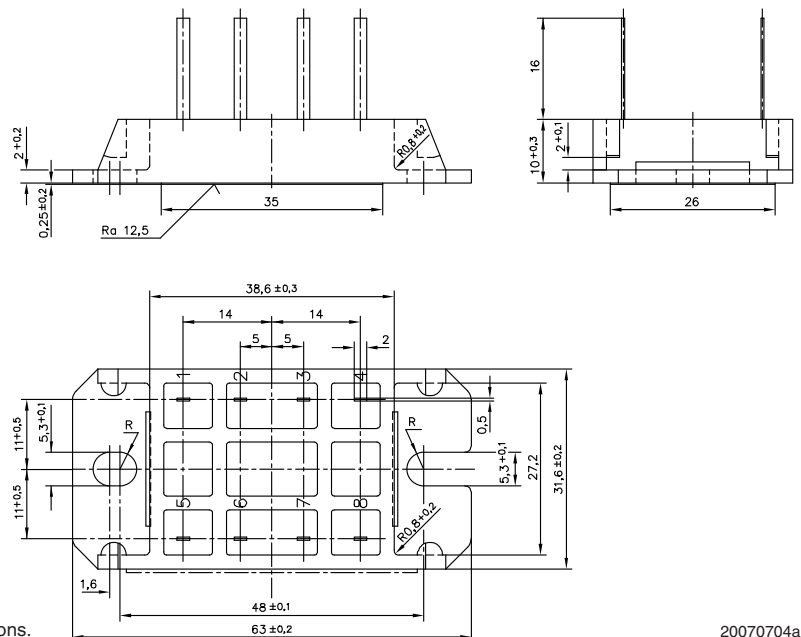


Fig. 1 Non-repetitive peak surge current (Rectifier Diodes)

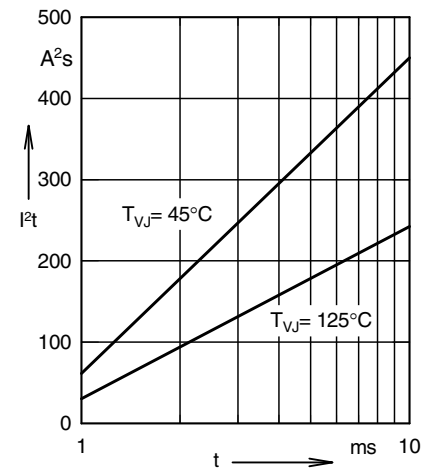


Fig. 2 I^2t for fusing (Rectifier Diodes)

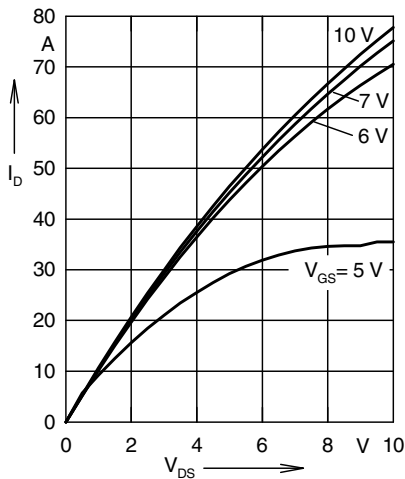


Fig. 3 Typ. output characteristic $I_D = f(V_{DS})$ (MOSFET)

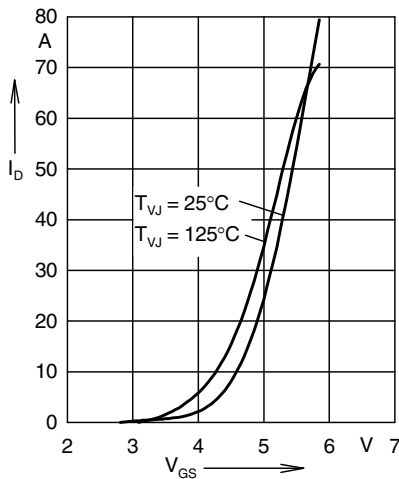


Fig. 4 Typ. transfer characteristics $I_D = f(V_{GS})$ (MOSFET)

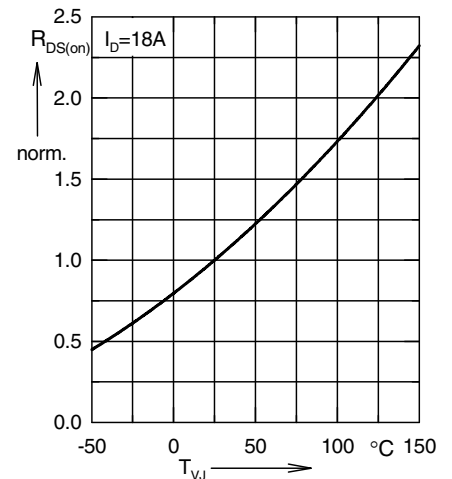


Fig. 5 Typ. normalized $R_{DS(on)} = f(T_{VJ})$ (MOSFET)

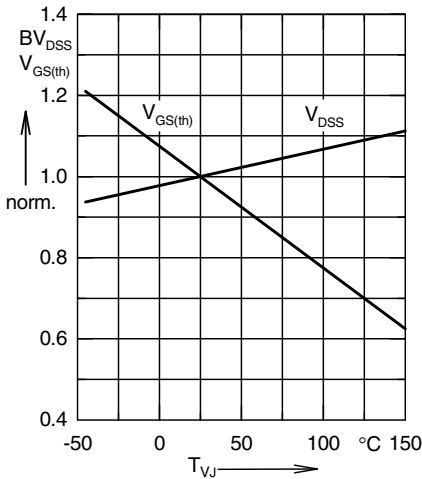


Fig. 6 Typ. normalized $BV_{DS(sat)} = f(T_{VJ})$
 $V_{GS(th)} = f(T_{VJ})$ (MOSFET)

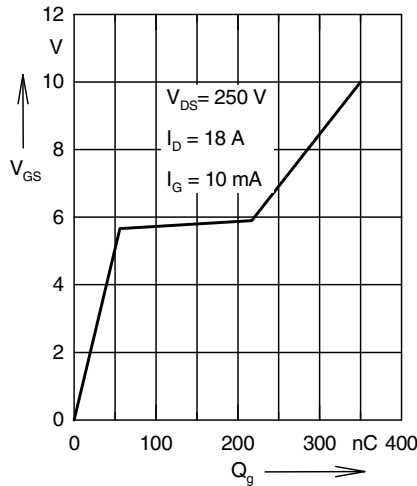


Fig. 7 Typ. turn-on gate charge characteristics, $V_{GS} = f(Q_g)$ (MOSFET)

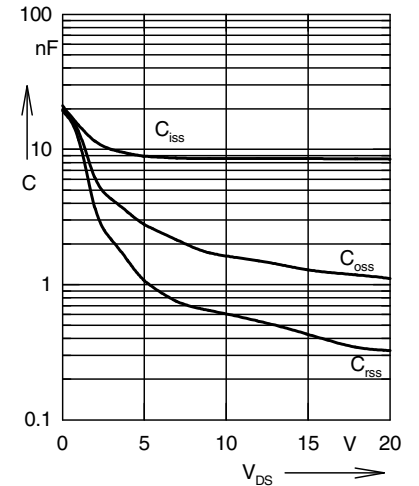


Fig. 8 Typ. capacitances $C = f(V_{DS})$, $f = 1 \text{ MHz}$ (MOSFET)

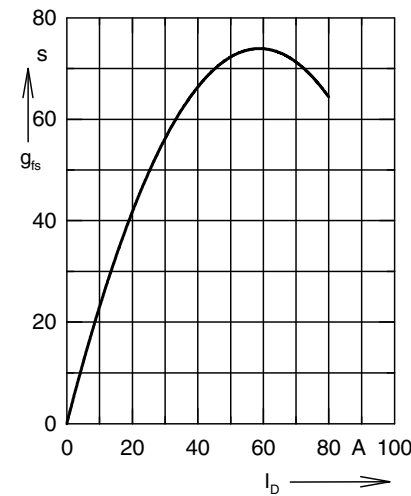


Fig. 9 Typ. transconductance, $g_{fs} = f(I_D)$ (MOSFET)

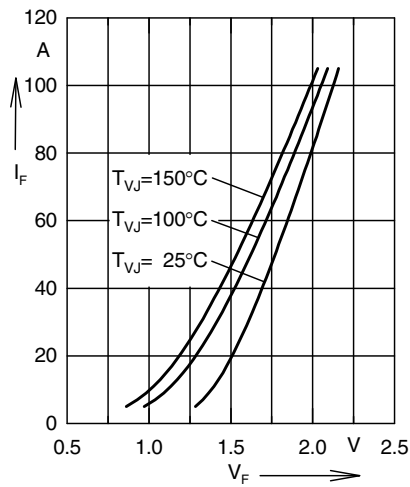


Fig. 10 Forward current versus voltage drop (Boost Diode)

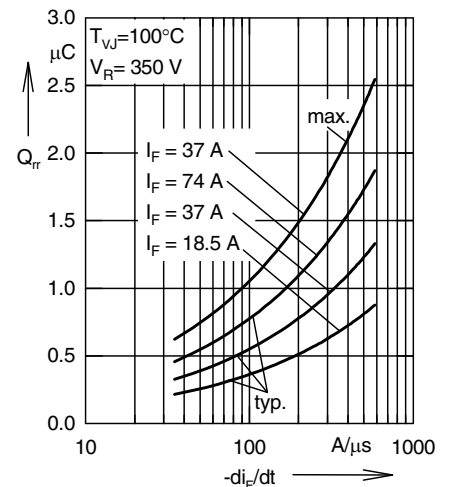


Fig. 11 Recovery charge versus $-di_F/dt$ (Boost Diode)

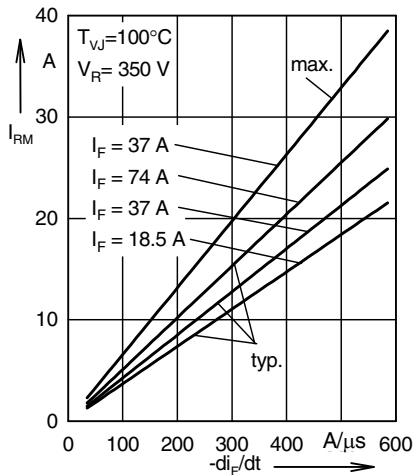


Fig. 12 Peak reverse current versus $-di_F/dt$ (Boost Diode)

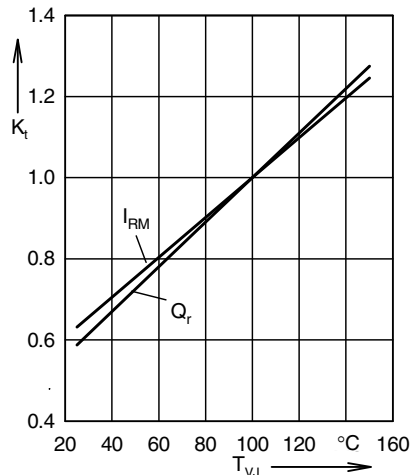


Fig. 13 Dynamic parameters versus junction temperature (Boost Diode)

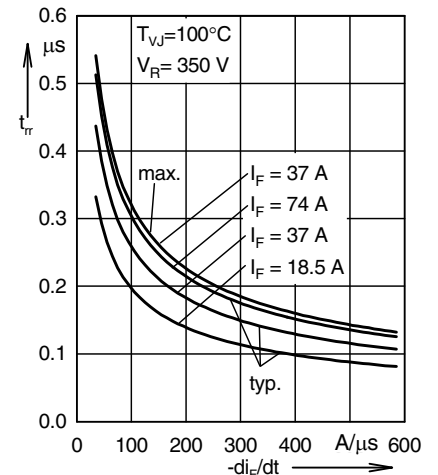


Fig. 14 Recovery time versus $-di_F/dt$ (Boost Diode)

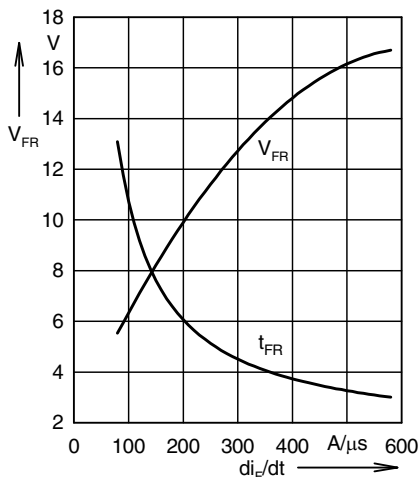


Fig. 15 Peak forward voltage versus $-di_F/dt$ (Boost Diode)

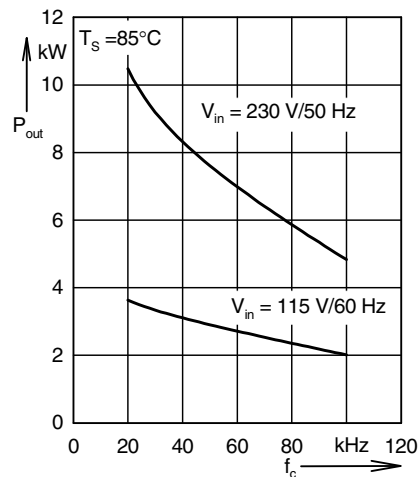


Fig. 16 Output power versus carrier frequency (Module)

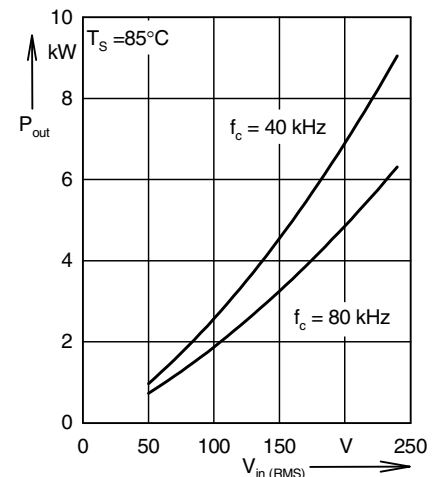


Fig. 17 Output power versus mains voltage

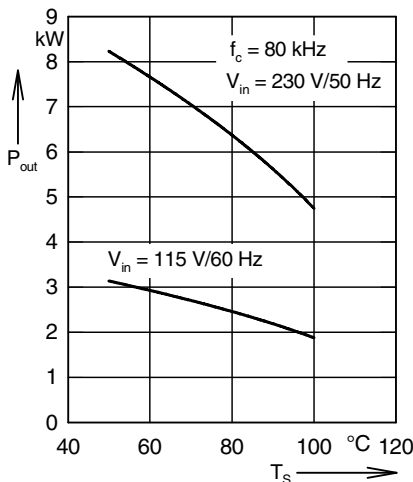


Fig. 18 Output power versus heatsink temperature (Module)

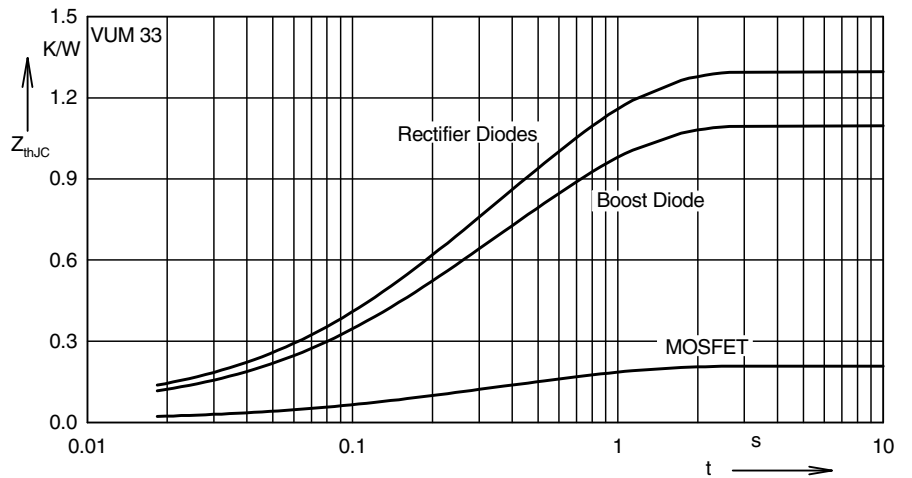


Fig. 19 Transient thermal impedance junction to case for all devices