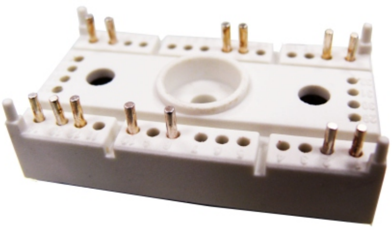
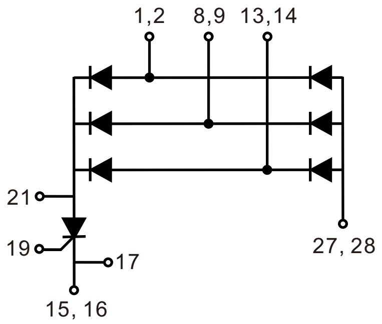
Three-Phase Bridge + Thyristor, 60A

(Low Profile Package)

FEATURES

- Three-phase bridge and a thyristor
- High surge current capability
- Planar thyristor chip
- Heat transfer and isolation through direct copper bonded aluminium oxide ceramic (DBC)
- Low thermal resistance
- Compliant to RoHS
- Isolation voltage up to 2500V
- Compact package, one screw mounting





Applications

- Inverter for AC or DC motor control
- Soft starters
- Switching power supply
- Light control
- Temperature control

ADVANTAGE

- International standard package
  Epoxy meets UL 94 V-O flammability rating
- Small volume, light weight
- Small thermal resistance
- Weight: 30g (1.06 oz.)

PRIMARY CHARACTERRISTICS	
$I_{F(AV)}$	60A
V_{RRM}	1200V to 1600V
I_{FSM}	1000A
I_R	10 µA
V_{FM}/V_{TM}	1.45V / 1.6V
$T_{J\ max.}$	150ºC

◎ Maximum Ratings for Diodes

MAJOR RATINGS AND CHARACTERISTICS (T_C = 25°C unless otherwise noted)

PARAMETER	SYMBOL	NK60TP		UNIT
		12	16	
Maximum repetitive peak reverse voltage	V_{RRM}/V_{RRM}	1200	1600	V
Peak reverse non-repetitive voltage	V_{RSM}	1300	1700	V
Output DC current three-phase full wave, T_c = 80°C	I_O	60		A
Peak forward surge current single sine-wave superimposed on rated load	I_{FSM}	1000		A
Rating (non-repetitive, for t greater than 1 ms and less than 8.3 ms) for fusing	I^2t	5000		A^2s
Operating junction temperature range	T_J	-40 to 150		ºC
Storage temperature range	T_{STG}	-40 to 125		ºC

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

PARAMETER	TEST CONDITIONS	SYMBOL	NK60TP 12	NK60TP 16	UNIT
Maximum instantaneous forward drop per diode	I_F = 75A	V_F	1.45		V
Maximum reverse DC current at rated DC blocking voltage per diod	T_C = 25°C	I_R	10		μA
	T_C = 150°C		6		mA

Maximum Ratings fo Thyristor

FORWARD CONDUCTION

PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNIT
Maximum average on-state current at case temperature	$I_{T(AV)}$	180° conduction, half sine wave, 50Hz			60	A
					80	°C
Maximum peak, one-cycle, on-state non-reptitive surge current	I_{TSM}	t = 10ms	No voltage reapplied	Sine half wave, initial T_J = T_J maximum	1500	A
		t = 8.3ms			1570	
Maximum I^2t for fusing	I^2t	t = 10ms			11250	A^2s
		t = 8.3ms			10230	
		t = 10ms	100%V_{RRM} reapplied		7870	
		t = 8.3ms			7160	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied			112.5	$kA^2\sqrt{s}$
Maximum on-state voltage drop	V_{TM}	I_{TM} = 200A, T_J = 25°C, 180° conduction			1.8	V
Maximum holding current	I_H	Anode supply = 6V, resistive load, T_J = 25°C			150	mA
Maximum latching current	I_L				250	

SWITCHING

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Typical turn-off time	t_q	I_{TM} = 300A, dI/dt = 15 A/μs, T_J = T_J maximum V_R = 50V, dV/dt = 20 V/dt, gate 0V, 100Ω	50 to 120	μs

BLOCKING

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Maximum peak reverse and off-state leakage current	I_{RRM} I_{DRM}	T_J = 125°C	20	mA
RMS isolation Voltage	V_{ISO}	60 Hz, circuit to base, all terminals shorted, 25°C, 60s	2500	V
Critical rate of rise of off-state voltage	dV/dt	T_J = T_J maximum, exponential to 67% V_{DRM}	1000	V/μs

TRIGGERING

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Maximum peak gate power	P_{GM}	$t_p \le$ 5ms, $T_J = T_J$ maximum	10	W
Maximum average gate power	$P_{G(AV)}$	f = 50Hz, $T_J = T_J$ maximum	5	
Maximum peak positive gate current	I_{GM}	$t_p \le$ 5ms, $T_J = T_J$ maximum	3	A
Maximum peak negative gate voltage	$-V_{GT}$		10	V
Maximum required DC gate voltage to trigger	V_{GT}	T_J = 25°C Anode supply = 6V, resistive load; R_a = 1Ω	2	
Maximum required DC gate current to trigger	I_{GT}		100	mA
Maximum gate voltage that will not trigger	V_{GD}	$T_J = T_J$ maximum, 67% V_{DRM} applied	0.25	V
Maximum gate current that will not trigger	I_{GD}		5	mA
Maximum rate of rise of turmed-on current	dI/dt	T_J = 25°C, I_{GM} = 1.5A, $t_r \le$ 0.5 μs	150	A/μs

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Operating junction temperature range	T_J		-40 to 150	°C
Storage temperature range	T_{stg}		-40 to 125	
Maximum thermal resistance, junction to case per junction	$R_{th(j-c)}$	DC operation	1.0	°C/W
Typical thermal resistance, case to heatsink per module	R_{thCS}	Mounting surface, smooth, flat and greased	0.30	
Mounting torque, ±10% module to heatsink, M4		A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound.	2	N·m
Approximate weight			30	g
			1.06	oz.

Ordering Information Table

Device code

NK	60	TP	12
①	②	③	④

1 - Nell's Low Profile Module
2 - Current rating : $I_{(TAV)}$ / I_O
3 - Circuit configuration type : "TP" for 3-phase bridge + thyristor
4 - Voltage code : code x 100 = V_{RRM}

Fig.1 Power dissipation per module vs. bridge output current

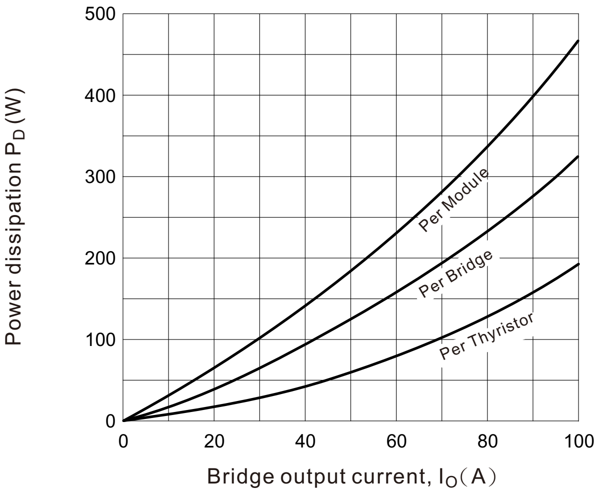


Fig.2 Forward current derating curve

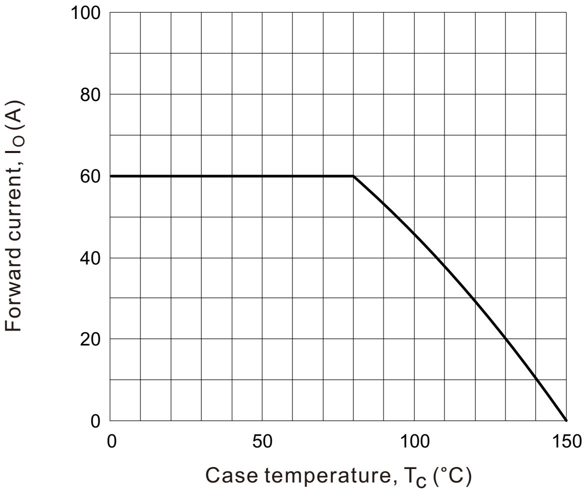


Fig.3 Transient thermal impedance

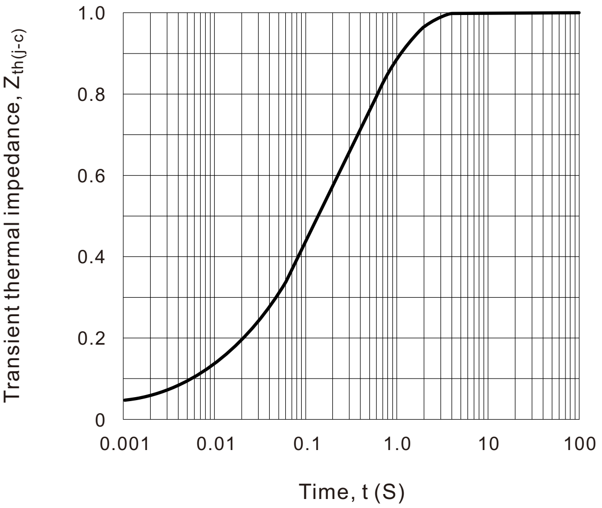


Fig.4 Max non-repetitive forward surge current

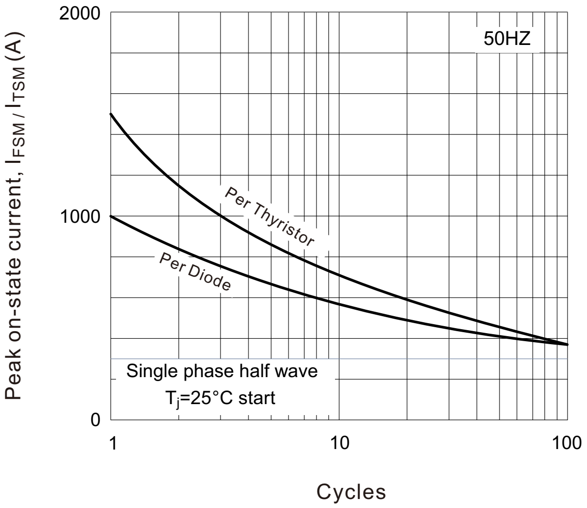


Fig.5 On-state characteristics

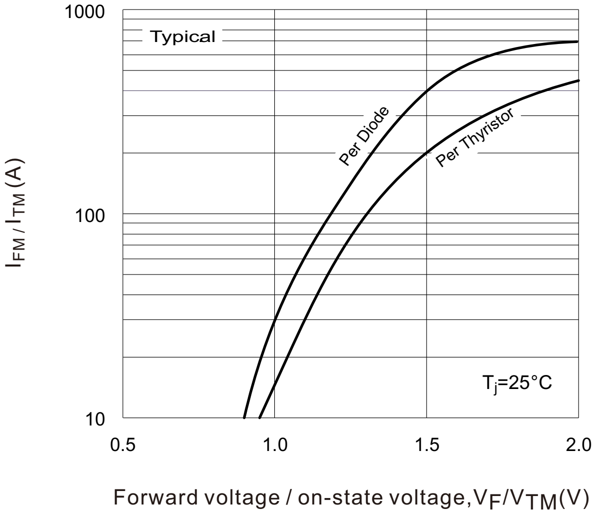
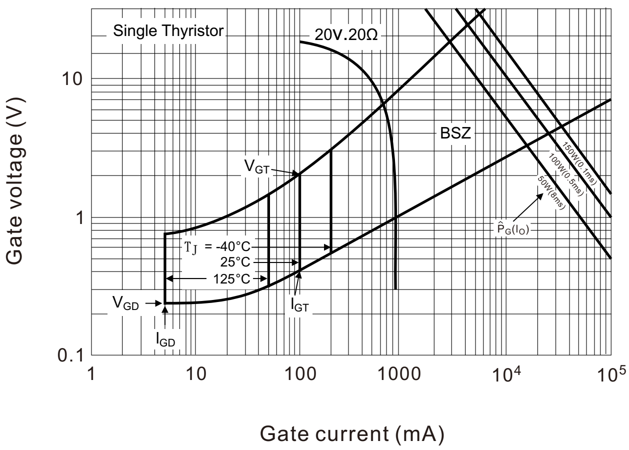
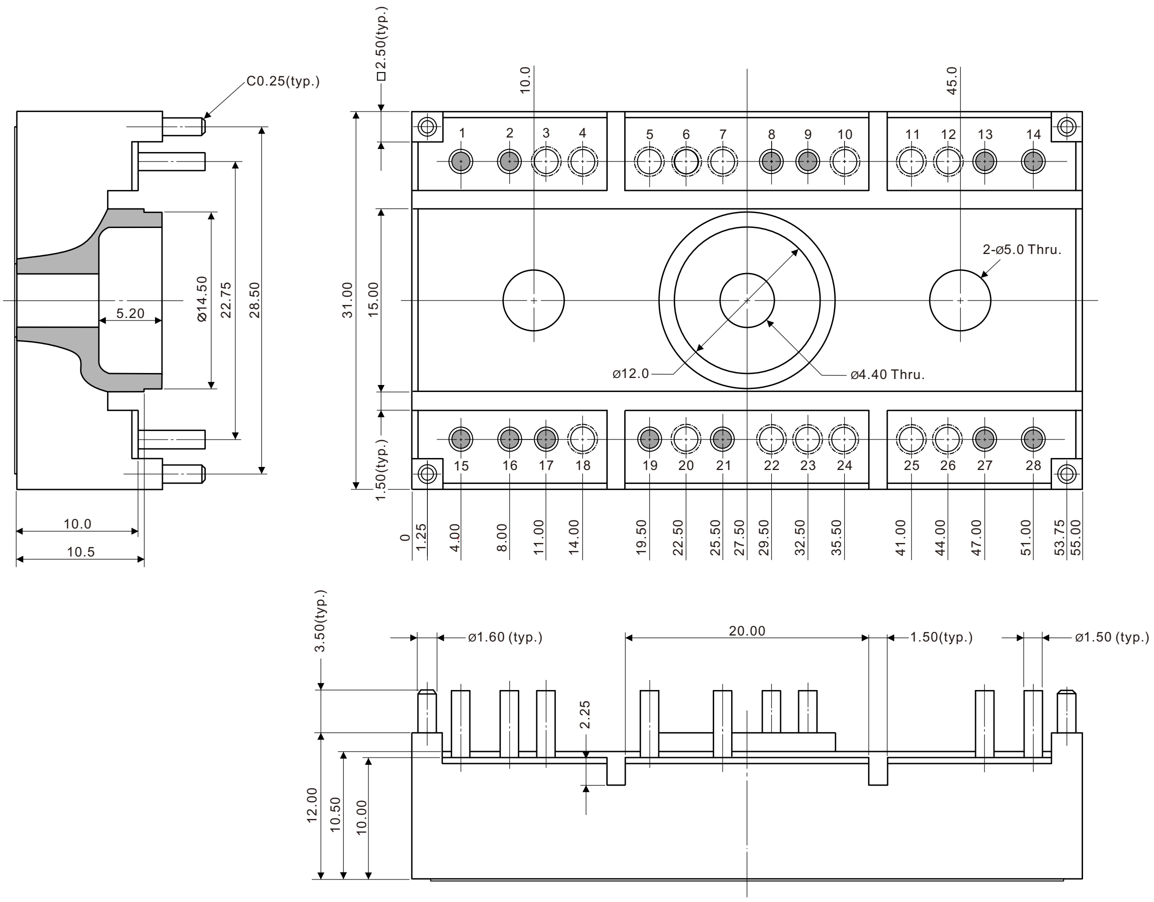


Fig.6 Gate trigger characteristics





Dimension Unit : mm

“TP” Circuit Configuration: